Communities and Local Government

Report of economic research related to the 2010 review of Building Regulations Parts A and C

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Europe Economics

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Department for Communities and Local Government

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SECTION 1

Consultation Stage Impact Assessment for the Adoption of the Eurocodes: Evidence Base

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1 EUROCODES

Introduction

1.1 The following material comprises the Evidence Base of the Impact Assessment on implementation of the European structural design codes throughout England and Wales.

1.2 This Impact assessment was carried out by Europe Economics with technical advice on the construction costs of buildings from Scott Wilson.

Background

1.3 Disparities in building design codes throughout the European Union may lead to discontinuity in safety standards and economic inefficiency in the design of buildings and civil engineering sectors. The European structural design codes (Eurocodes) will serve to bridge such gaps by establishing a uniform EU-wide set of codes and guidance. In addition to fostering EU harmonisation goals and removing barriers to trade, the Eurocodes should increase construction sector competition, while providing a common understanding of safety standards regarding the design of structures between owners, operators, users, designers, contractors and manufacturers of construction products.

1.4 Following some 30 years of development, the Eurocodes consist of ten common European standards for the design of construction works. The Eurocodes have been published as 58 parts by the European national standards bodies in all main European languages between 2002 and 2007. After the period of co-existence, they will be replacing all existing conflicting national codes by March 2010. In particular, these codes are designed to cater for all major materials and the ten parts are as follows:

(a) Eurocode 0: EN 1990 Basis of structural design;

(b) Eurocode 1: EN 1991 Actions on structures (10 parts);

(c) Eurocode 2: EN 1992 Design of concrete structures (4 parts);

(d) Eurocode 3: EN 1993 Design of steel structures (21 parts);

(e) Eurocode 4: EN 1994 Design of composite steel and concrete structures (3 parts);

(f) Eurocode 5: EN 1995 Design of timber structures (3 parts);

(g) Eurocode 6: EN 1996 Design of masonry structures (4 parts);

(h) Eurocode 7: EN 1997 Geotechnical design (2 parts);

(i) Eurocode 8: EN 1998 Design of structures for earthquake resistance (6 parts);

(j) Eurocode 9: EN 1999 Design of aluminium structures (5 parts).

1.5 Aside from EN 1990, each Eurocodes has several parts (as shown in the parenthesis above) bringing the total number of parts up to 58.

1.6 They have been designed with the following beneficial aims in mind:[1]

(a) To provide a common approach for the design of buildings and other civil engineering works leading to enhanced competition at an EU level;

(b) To boost business in the sector by removing technical barriers to trade within the EU;

(c) To foster improvements in quality and innovation; and

(d) To create job opportunities in the sector.

1.7 Note that while Eurocodes are intended to provide a set of common technical rules for the design of construction works, certain parameters such as the safety levels of construction works will still be determined at a national level. As such, Eurocode guidelines will contain tailored National Annexes containing details of nationally determined factors. The National Annexes will also contain country-specific data, and will state the method to be used if there are alternative methods allowed in the Eurocode.

1.8 In the UK, Eurocodes are due to replace the British Standards design codes, currently covered in the Building Regulations. The British Standards Institute (BSI) is responsible for the preparation and publication of the UK annexes. Currently, all 58 Eurocodes have been published by BSI and 44 UK National Annexes are available. Some companies have already begun to use the Eurocodes for small scale projects to familiarise themselves with the processes involved. Of the 58 parts to the Eurocode, the Eurocode and National Annex had been published for 39 parts; for the remaining parts, the Eurocodes have been part-published and the Annexes are being awaited.

Options

1.9 The Eurocodes will be implemented by March 2010, and thus there are no other possible viable policy options.

1.10 While we acknowledge the inevitability of this policy change, in order to properly analyse the impact of the Eurocodes, we must define a hypothetical counterfactual which assumes no change in the British Standards. By assessing the difference between the two scenarios we can isolate the impacts due to Eurocode implementation, and separate them from any changes that would have occurred independently.

1.11 The relevant Eurocodes which are included in AD A and AD C imply a number of changes and these are set out in Table 1.1 below. As indicated in this table, there is only one

[1] European Commission (2009)

Eurocode driven change to AD C and this change has no material impact on the structural aspects with respect to the regulations that currency apply in this area under the BS codes and should therefore have no impacts on costs, or indeed any corresponding benefits. It is for this reason that we have not attempted to assess the impact of Eurocode driven changes to AD C in this impact assessment.

Table 1.1: Eurocode-driven Changes to Approved Document A

Approved Document	**Section and paragraph**	**Nature of suggested change**	**Content area changed**
AD A	"Use of guidance"	replacements	On obligations to follow ADs
	2A2d	replacement	BS code change
	2C	addition	Clarification, Eurocode reference
	2C3c	replacement	BS code change
	2C3e	replacement	BS code change
	2C17	replacement	BS code change
	2C20	deletion	BS codes
		addition	BS code change
	2C21	addition	BS codes
	Diagram 13	comment	Change dimension requirement
	2E2b	deletion	BS code
		addition	BS code change
		replacement	70 sq m increased to 100
	5.2	replacement	BS code change
		addition	seismic design reference
	"Standards referred to"	comment	Updating of BS

Source: CLG revisions to Approved Document A, 2009

Methodology and Key Assumptions

Introduction

1.12 As noted above, only those changes to AD A which are Eurocode driven are considered in this impact assessment and our methodology therefore, only makes references to the these changes. The other proposed changes to AD A and AD C are the object of two separate Impact Assessment studies.

1.13 The remainder of this section is set out under the following sub-headings as follows:

(a) Assessment of the implementation costs of the Eurocodes – this section sets out our methodological approach to estimating the one-off costs of adopting the Eurocodes;

(b) Technical construction of the engineering analysis for the assessment of the impacts on construction costs – this section discusses our methodological approach to assessing the impacts on construction costs under the new codes based on the technical expertise provided by out by our technical advisor; and

(c) Qualitative assessment of impacts – this section provides a discussion of our approach to assessing other economic impacts of implementing the structural Eurocodes as well as assessing any possible social impacts.

Assessment of the implementation costs of the Eurocodes

1.14 The costs (or benefits) in complying with the structural Eurocodes when constructing new buildings (the methodology for assessing these is discussed below) will constitute an ongoing cost (or benefit) of the Eurocode proposals.

1.15 However, there will also be one-off costs imposed by this proposal and these will be largely incurred by consultancies which specialise in building structural designs.

1.16 Europe Economics' methodological approach to estimating what these one-off costs are likely to be for an average consultancy in the industry is based on a report published in 2004 by the Institution of Structural Engineers (ISE) – 'National Strategy for Implementation of the Structural Eurocodes: Design Guidance – April 2004'. This report provided estimates on the costs of adopting the Eurocodes. Our approach has been to refine some of the assumptions underlying these estimates where appropriate and to adjust the 2004 cost figures in line with inflation.

Technical construction of the engineering analysis for the assessment of the impacts on constructions costs

1.17 In order to analyse the main impacts of the changes to be introduced a key component of our methodological approach included the employment of notional building designs using the current and the proposed standards in order to assess what the impacts of adopting Eurocodes would be on the cost of constructing these buildings in practice. Our subcontractor has provided us with the necessary technical analysis of the changes in construction costs implied by the adoption of the Eurocodes.

1.18 As agreed with the CLG, the relevant codes Structural codes considered here include EN1990, EN1991, EN1992, EN1993, EN1994, EN1995 and EN1996. Also as agreed with the CLG, EN 1998 and EN 1999 are not considered here because of their relative insignificance to the UK's construction industry. Similarly, as per specification of CLG, EN 1997 for foundation design is not within the scope of this impact assessment.

1.19 The methodology followed in constructing and costing the building designs was as follows.

(a) Part 1: Structural Design for Cost Comparison

- Identifying Types (uses) of Buildings (TB) to consider.
- Identifying Types of Materials (TM) to consider.
- Identifying Ground Conditions (GC) to allow different foundations.
- Identifying types of relevant actions to consider.
- Proposing buildings (geometry) to be designed.
- Designing the buildings using British Standards. (Structural Design only. However, structural fire safety has been considered. Detailing to suit costing purposes only.)
- Designing the buildings using Eurocodes. (Structural Design only. However, structural fire safety has been considered. Detailing to suit costing purposes only)
- Costing the construction of each design.

(b) Part 2: providing comments on the proposed Eurocode driven changes to AD A.

Part 1

1.20 The basic details of the notional buildings designed to both Eurocodes and British Standards so that cost comparisons can be made, are provided below. These buildings, designed for cost estimation purposes, were:[2]

(a) A two-storey detached house with masonry walls, timber floors and traditional timber rafter roof.

(b) A single-storey office block, constructed similar to the above house.

(c) A seven-storey office building, constructed of reinforced concrete in-situ building to assess the effect of changes to Class 2B building disproportionate collapse requirements to that of EN 1991-1-7,

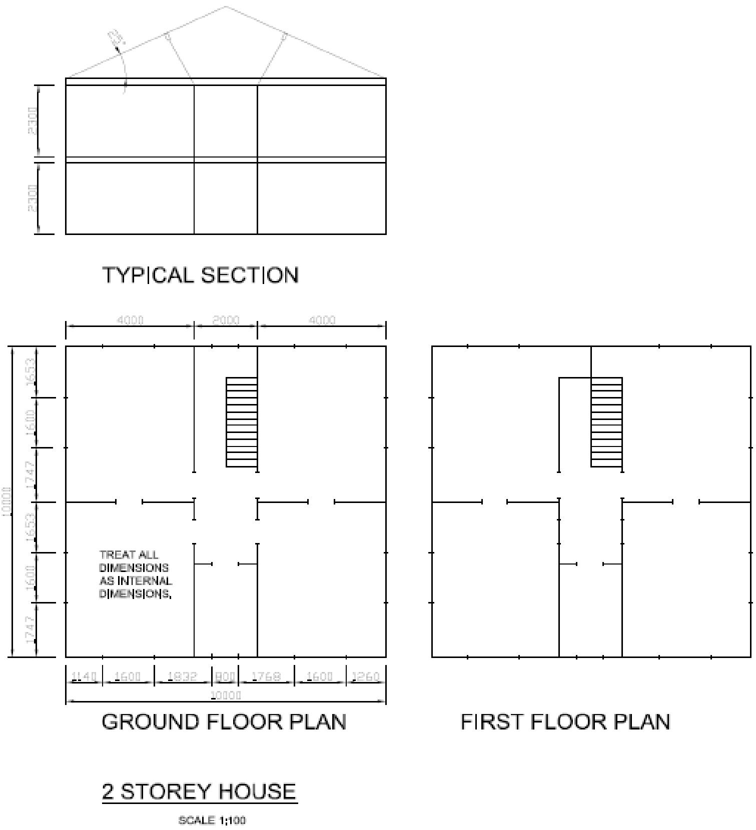
(d) A seven-storey office building similar to the concrete building above, but now of steel and steel-concrete composite construction but without shear walls and slightly shorter than the former.

1.21 This selection of buildings is meant to reflect the population of UK buildings affected by the implementation of Eurocodes. We settled on using the above sample only following

[2] The structural design of these buildings includes aspects that will be affected by the Eurocode-related changes to the Approved Documents A. We identified earlier in our discussion why AD C is not included here in this impact assessment.

discussions with CLG and broad agreement by interested parties during a BRAC Working Party meeting.[3] These notional buildings are illustrated in figures 1.4-1.7 below.

Figure 1.1: Masonry and 2-storey house

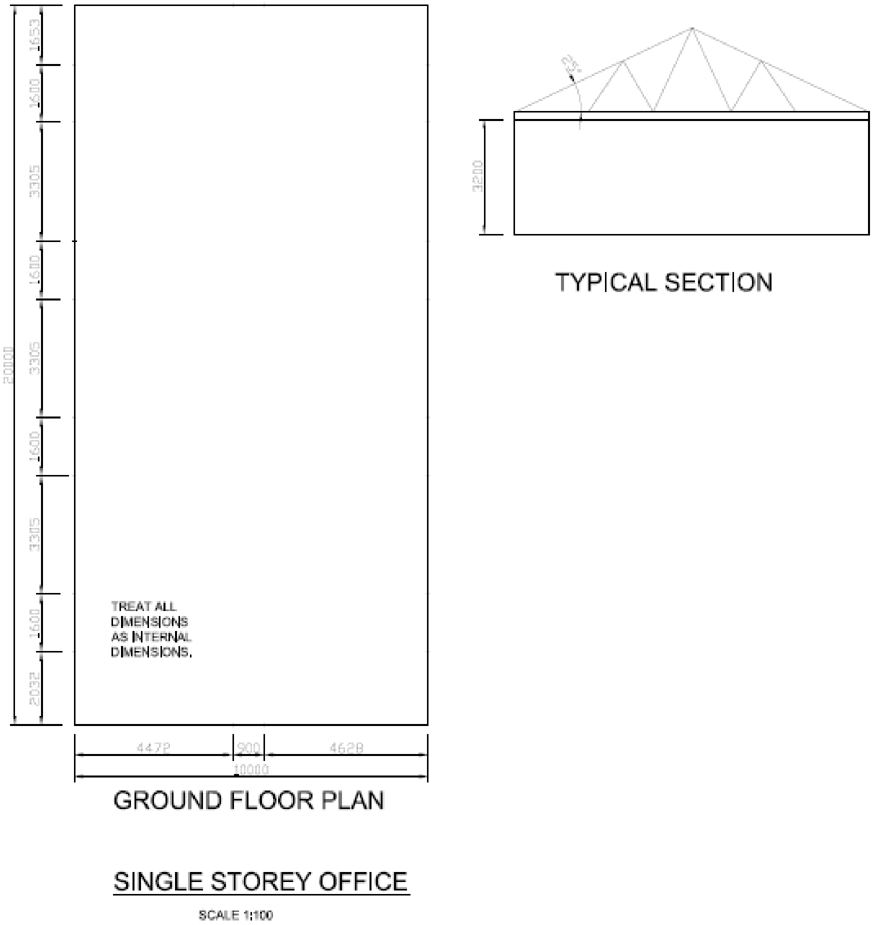


Source: Scott Wilson

1.22 The specification for the two-storey detached domestic house (presented in Figure 1.1 above) to be located in an urban area of Oxford, is provided in Appendix 1: .

3 27 April, 2009, at the CLG offices at Eland House.

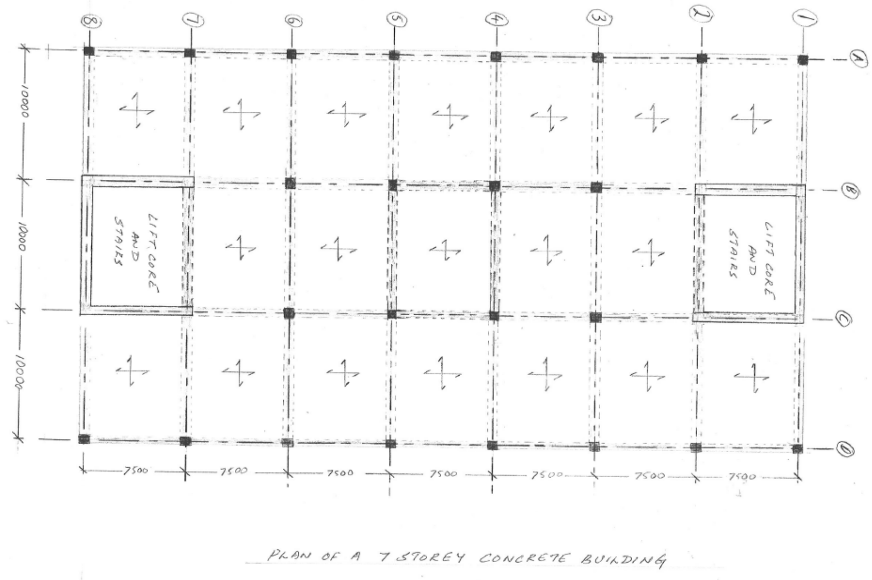
Figure 1.2: Masonry and timber single-story office



Source: Scott Wilson,

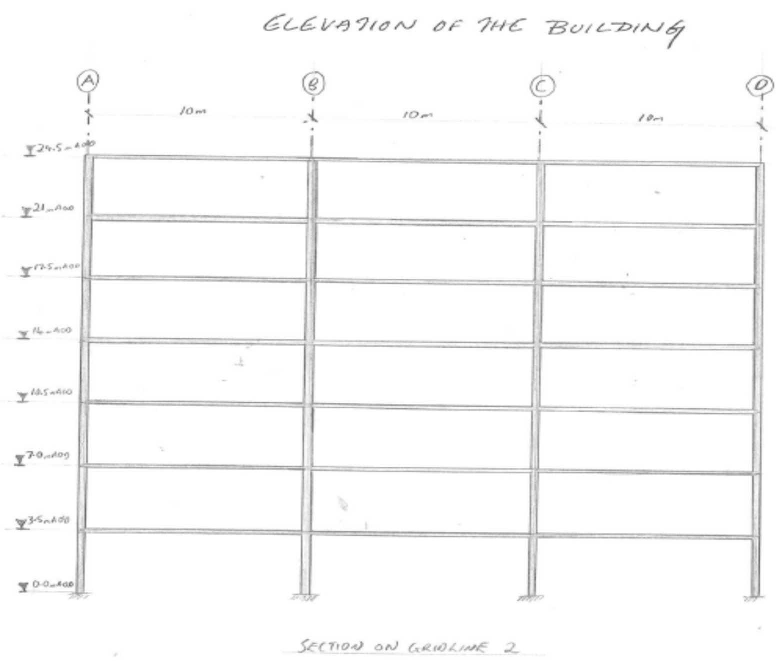
1.23 The specification for the single-storey office building (presented in Figure 1.2 above), to be located in an urban area of Oxford, is provided in Appendix 1: .

Figure 1.3: 7-storey concrete office building (plan view)



Source: Scott Wilson, 2009

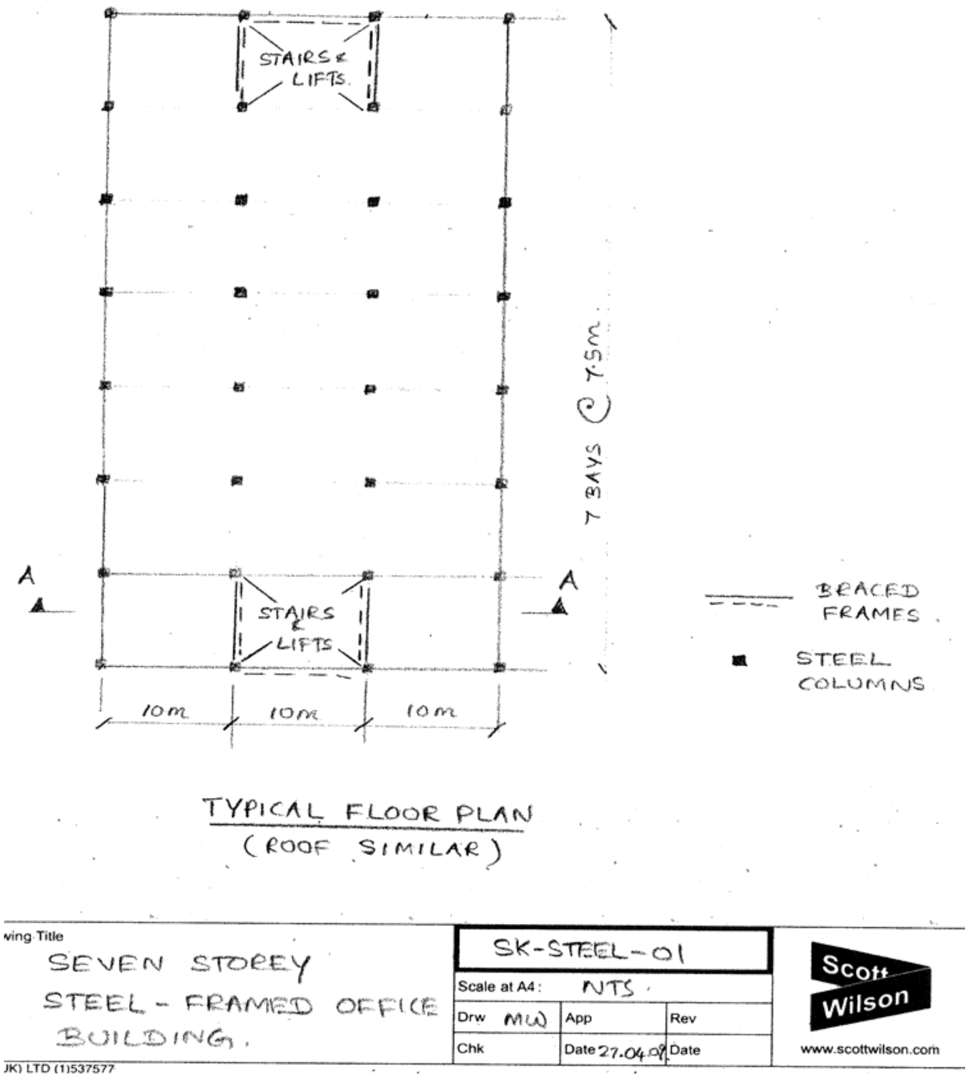
Figure 1.4: 7-storey concrete office building (sectional view)



Source: Scott Wilson

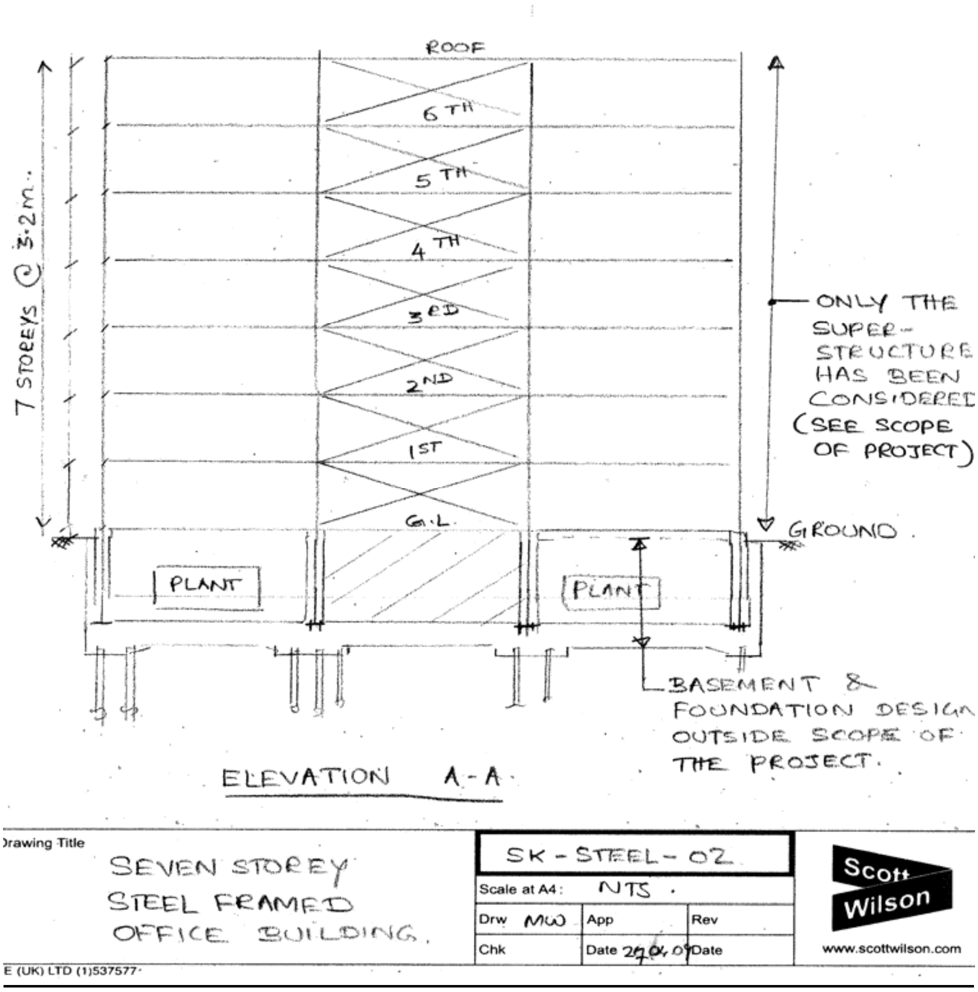
1.24 The specification for the seven-storey office building (presented in Figure 1.3 and 1.4 above), to be located in London, is provided in Appendix 2. Although this is similar to the steel building shown presented Figure 1.5 below, the two are not identical. The concrete building has storeys taller than that of the steel building and incorporates strong concrete shear walls that provide additional protective and safety measures to the stair/lift regions.

Figure 1.5: 7-storey steel office building (plan view)



Source: Scott Wilson

Figure 1.6 7-storey steel office building (sectional elevation)



Source: Scott Wilson

1.25 The specification assumptions for all of the notional buildings presented in Figure 1.1 -1.6 are provided in Section 2. A summary of the structural design's outcome is also provided in the following section.

Aggregating the impact on construction costs for the projected new buildings

1.26 The cost of constructing such notional buildings was then aggregated using projections of future new housing that were obtained from BRE.[4] As the domestic and non-domestic dwellings for which we had projected figures did not correspond exactly to the notional buildings used in this costing exercise for the purposes of this study, we made a number of assumptions in order to make the aggregation.

[4] BRE has provided this data based on information collected from a number of sources including ABI, BERR, and CLG.

1.27 In particular, we had to make assumptions on the following aspects:

(a) Building projections for individual building categories have been made on the basis of total floor space as opposed to the total number of individual buildings. In order to estimate the total number of projected new builds from this data, we made assumptions about the average floor space for each building type (i.e. those for which floor space projections have been made) and then divided the total projected new floor space value by the average figures. Our assumptions about average floor spaces were based on estimates made by Faber Maunsell (now AECOM) in a previous impact assessment carried out for the CLG.[5]

(b) Differences between buildings – our approach was to make assumptions about the relative differences between our domestic and non-domestic notional buildings and the types of buildings for which projections of the number of new builds have been estimated. We set out these assumptions in more detail in Tables 2.8, 2.9, 2.10, and 2.11 in Section 2. These tables also provide our aggregate cost estimates.

(c) Distribution – our approach also included making assumptions based on recent market data about the proportion of projected non-domestic builds that will be built using both masonry and timber, concrete or steel.

Part 2

1.28 Some comments on the proposed changes to Eurocode-related changes to AD A are reported in Appendix 2: .

Qualitative assessment of impacts

1.29 In addition to the cost benefit modelling it is also necessary to consider whether the Eurocodes will have other economic or social impacts.

1.30 While we seek to determine the impact of the policy on each of the areas identified through the specific Impact Tests (please see our cost benefit analysis in Section 2), at this stage our expectation is that the main impacts will be on business, competition and distributional impacts.

1.31 For this section of the IA, we drew on the knowledge of stakeholders and we carried out interviews to explore market impacts, cost structures, ability to respond to change and other factors. This is especially crucial to our estimates of the costs and benefits of Eurocodes.

1.32 Stakeholders with whom we considered consulting include:

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[5] Impact Assessment for Amendments to Building Regulations Part F and L.

(a) The Concrete Centre;

(b) Steel Construction Institute;

(c) British Constructional Steelwork Association;

(d) International Masonry Society; and

(e) The Timber Research and Development Association (TRADA).

Cost/Benefit Analysis

Impacts on structural building design costs

1.33 In the above section we defined the costs that consultancies specialising in structural design would need to incur in order to implement the new codes into their business practices as one-off costs (i.e. those that would only need to be incurred once on account of adapting to the Eurocodes). These one-off costs are likely to include the following (this is not an exhaustive list):

(a) purchasing the structural codes and the National Annexes;

(b) purchasing guidance documents;

(c) attending technical seminars; and

(d) adapting in-house practice to comply with the Eurocodes.

1.34 According to a study carried out in 2004 by the Institution of Structural Engineers, the total costs of adopting the Eurocodes within a consultancy with 16 fee-earning technical staff specializing in building structures are approximately £255,000. The costs would be incurred as a one-off expense during the first year of implementation. Table 1.2 below provides a breakdown of this figure into its constituent components.

Table 1.2: Estimate of the One-Off Costs of Adopting the Eurocodes within a Consultancy with 16 Technical Staff Specialising in Building Structures

Item	Cost (£)
Cost of purchasing 1 set of structural Eurocodes including National Annexes (estimate)	2,750
Cost of buying guidance documents (assumed)	1,000
Cost of updating software (assumed)	20,000
Attendance at technical seminars (assume 3 days per person)	
Cost of seminars (assume £150 net each seminar) = 13x3x£150	7,200
Cost of attendance = £16x3x7.5x£50	18,000
Familiarisation with codes in the office (assume 12 man days for each person) = £16x12x7.5x£50	72,500
Alterations to standard ‘in house’ specification documents (allow 14 documents at average of 1 man –day each) = £14x7.5x£50	5,250
Loss of productivity during the first year of change(assume an average annual billing (productive time) = 1600 hours and 10 per cent loss of productivity) = 1600x16x0.1x£50	128,000
TOTAL	**254,700**

Source: Institute of Structural Engineers (2004)

1.35 As can been seen from the above table, the total implementation cost estimated here is very sensitive to assumptions made with regard to the expected loss of productivity that is likely to arise as a result of having to adjust to the new codes. We have refined this estimate in the following ways:

(a) **Passing of time** — because the estimates above date back to 2004, we assume that during the five years since then the implementation processes in England and Wales would be well underway; familiarization, purchasing codes, and alteration of current documents are likely to have begun. As such, we calculate a few scenarios to include this assumption in our model: 2.5 per cent implementation, 5 per cent implementation, or 7.5 per cent implementation of Eurocodes by 2009.

(b) **Revising the cost of purchasing Eurocodes** — we do not believe it is realistic to expect all firms to purchase the complete set of 58 Eurocodes, but only those that are practically necessary for the work carried out in relation to AD A. Through discussions with CLG we estimate that approximately 42 Eurocodes are applicable to AD A, or approximately 11 of the 15 available “packages”. We therefore revise the purchasing cost accordingly downward.

(c) **Decreasing cost of updating software** — much of the cost of updating software would have decreased significantly since 2004 due to technological advances. Moreover, beyond this, we expect that because the Eurocode implementation will be and already is seen as such a major change, most of the existing software will, driven by competition in the market, incorporate the new codes into annual updates. This will further reduce any additional cost for updated software had by the Eurocodes by at least 50 per cent.

Based on current software packages, we believe that updated versions may also aid in company familiarisation processes — for example, with interactive learning modules — and offset some of the expected productivity loss to Eurocodes.

(d) **Other drivers of implementation** — it would be inaccurate to attribute UK implementation of the Eurocodes to AD A. In the first place, it is likely that a number of internationally-focused EU firms will transition to Eurocode-based procedures in any of the other 26 Member States. There is also an important dynamic aspect to take into account, characterised by pre-emptive implementation of the codes by leading market players in order to stay ahead of the curve (the pre-emptive behavior of certain firms would be independent of the general time passing described above). The proportion of firms we can expect to pre-emptively learn Eurocodes depends primarily on the deadline that is set for complete implementation, which is unknown at the time of this Impact Assessment. We would attribute no more than 75 per cent of Eurocode implementation in the UK to the publication of the revised AD A.

(e) **Adjusting the assumption about productivity loss** — in the above estimate the assumptions about the loss in productivity, account for over half of the total implementation cost. We believe that the 10 per cent assumption is likely to be an overestimate and that this is largely because losses in productivity will already have been captured to some extent within some of the other cost categories, for example in attending seminars, and time spent in becoming familiar with the codes. One contributing factor to this is the current Continuous Professional Development (CPD) requirement for industry members to undergo one week of professional training per year; this amounts to approximately 2.5 per cent of annual labour time spent fostering productivity. Given the timeliness and importance of Eurocode implementation, these seminars would doubtless include education on them.

Thus, accounting for productivity loss in the way it has been done above, suggests some element of double counting will have been carried out. Because the overlap between productivity loss and offsetting components (e.g. familiarisation, CPD, intra-company knowledge spillover, interactive software, pre-existing adoption initiatives, etc.), we revise the 10 per cent assumption of productivity loss into three scenarios of a 2.5, 5 and 7.5 per cent net productivity loss.

(f) **Accounting for inflation** — Having revised the estimate according to the above refinement, adjust the new estimate to account for inflation changes between 2004 and 2008. According to CPI data published by the OECD, UK inflation between 2004 and 2008 was 6.5 per cent.

1.36 The assumptions discussed above upon which these figures are based will be explored in more detail in the Consultation process.

1.37 Given the variations built into our cost assumptions, there are now nine possible scenarios to examine. For simplicity, we present the lower and upper bounds of the possible range (“best case” and “worst case” scenarios), and a middle-of-the-road scenario based on moderate assumptions both about productivity loss and implementation over the last five years:

1.38 "Worst-case”

- 2.5% implementation by 2009
- with 7.5% productivity loss

1.39 "Moderate cost”

- 5.0% implementation by 2009
- with 5.0% productivity loss

1.40 "Best-case”

- 7.5% implementation by 2009
- with 2.5% productivity loss

1.41 Table 1.3 below shows a revised version of Table 1.2, using assumptions for our Worst Case Scenario.

Table 1.3: Revised "Worst Case Scenario" Estimate of the Costs of Adopting the Eurocodes within a Consultancy with 16 Technical Staff Specialising in Building Structures

Item	Cost (£)
Cost of purchasing 1 set of structural Eurocodes including National Annexes (estimate) = £2,750x(11/15)	2,000*
Cost of buying guidance documents (assumed) = £1,000x(11/15)	750*
Cost of updating software (assumed) =0.5x£20,000	10,000*
Attendance at technical seminars (assume 3 days per person)	
- Cost of seminars (assume £150 net each seminar) = 13x3x£150	7,200
- Cost of attendance = £16x3x7.5x£50	18,000
Familiarisation with codes in the office (assume 12 man days for each person) = £16x12x7.5x£50	72,500
Alterations to standard 'in house' specification documents (allow 14 documents at average of 1 man –day each) = £14x7.5x£50	5,250
Loss of productivity during the first year of change(assume an average annual billing (productive time) = 1600 hours and 7.5 per cent loss of productivity) = 1600x16x0.075x£50	96,000*
SUB-TOTAL (before adjusting for inflation at 6.5 per cent, passing of time, and accounting for other drivers of implementation)	211,700*
TOTAL	**164,868**

**Estimate has been revised following changes to underlying assumptions*

Source: Institute of Structural Engineers (2004), Europe Economics (2009)

Aggregate transition costs

1.42 The above estimate is based on the assumption of a consultancy with 16 engineers. Multiplying the average costs for one engineer by the total number of structural engineers that are members of the Institution of Structural Engineers provides an estimate of the total transition costs that will be expected to arise as a result of adopting the Eurocodes.[6]

1.43 Table 1.4 below sets out these figures, for each of three possible scenarios.

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6 While we do not expect every member of the ISE to comply with the transition to Eurocodes, as some members may be retired or not practicing the profession anymore; we nevertheless assume that there are bound to be other associations and institutions complying which we are presently not taking account of such as e.g. civil engineers. Therefore we are settling on the total number of registered structural engineers as our estimate for the number of parties incurring transition costs.

Table 1.4: Aggregate transition costs

Scenario	Expected transition cost per structural engineer (£)	Total number of registered structural engineers	Aggregate transition costs (£million)
Best-case: 7.5% implementation by 2009 with 2.5% productivity loss	6,820	17,552	120
Moderate cost: 5.0% implementation by 2009 with 5.0% productivity loss	8,522	17,552	150
Worst-case: 2.5% implementation by 2009 with 7.5% productivity loss	10,304	17,552*	181

** This figure was obtained from the Institution of Structural Engineers*

Source: Europe Economics calculations

1.44 We estimate the total one-off transition costs to implementing the Eurocodes to be in the range of £120 to £181 million. After the initial costs (including one-off costs of enforcement) we expect there to be no further transition costs to implementation. We believe that any future periodic updating of the Eurocodes would be sufficiently minimal to be covered by CPD.

Two-storey detached domestic house

1.45 We now set out the design specifications of the four notional buildings used for the purposes of this impact assessment and we provide the estimated differences in the constructions costs under these specifications, between the current and the Eurocode building standards.

Specification and assumptions

1.46 The specifications for the construction of a notional two-storey detached domestic house are set out below.

(a) Ground floor –150mm pre-cast concrete bean and block floor with 40mm rigid insulation and 75mm sand cement screed.

(b) First floor – timber floor joists @400mm c/c with solid blocking at ends amd mid-span built into masonry walls. 19mm tongue and grooved floor boarding. Plaster board ceiling and skim. 30x5x1200mm steel lateral restraint streaps@1200mm c/c to agble walls.

(c) Roof – concrete tiles with roof and battens on common rafters @ 400mm c/c on 100x50mm wall plate. Two lines of purlins supported at 2500mm c/c by 75x75mm timber props down to internal wall. Ceiling joists 200x50mm C16 timber @400mm c/c with rockwall insulation and plaster board ceiling and skim. 30x2.5x120mm steel lateral restraint straps @1200mm c/c to gable walls. 30x2.5x1200mm timber roof bracing.

(d) External wall – 102.5mm facing clay brickwork, 75mm cavity with 50mm rigid insulation, 100mm 5.0N solid concrete block-work. Two coat plaster, standard duty to hat cavity lintels to openings.

(e) Internal wall – 100mm solid concrete block-work. Two coat plaster on both sides. First floor walls may be 100mm masonry or 100x50mm load-bearing timber studwork., Standard duty 100mm pcc lintels to openings.

Basis of cost calculations

1.47 The two designs, to British Standards and European Standards, both comprise masonry load bearing walls together with pcc suspended decking ground floor, timber joist upper floor structure and a timber (non-trussed rafter) roof structure. The various elements have been quantified for each design with minor differences noted. Current market rates have been applied to the quantities to produce element costs for each design. The rates applied to each design remain constant to provide an equal comparison of the differences in quantity of each design.

Cost comparison between British standards and Eurocodes

1.48 Table 1.5 below provides a summary of the total construction costs of a notional two-storey detached house under the current standards compared with the costs under the new structural Eurocodes. As can been seen from this table, the construction cost is actually slightly cheaper under the Eurocodes. This difference is however, very small both in absolute terms (i.e. £115 less under the Eurocodes) and in relative terms (approximately 0.3 per cent cost difference).

Table 1.5: Cost summary – Two-storey detached house

Building type	Construction costs under British Standards (£)	Construction costs under Eurocodes (£)	Change (£)	Change (%)
Two storey detached house	40,621	40,505	-116	-0.28

1.49 A detailed breakdown of the cost components is presented in Appendix 1.

Single storey office

Specification assumptions

1.50 The specifications for the construction of a notional single-storey office block are set out below.

(a) Ground floor – 150mmprecast concrete beam and block floor with 40mm rigid insulation and 75mm sand cement screed.

(b) Roof – concrete tiles with felt and battens on trussed rafter roof span 10m @ 600mm c/c on 100x50mm wall plate. Rigid insulation with mf suspended ceiling. 30x20x5x1200mm steel lateral restraint straps @1200mm c/c to gable walls. 30x2.5x1200mm steel vertical straps @1200mm c/c to wall plate. 125x25mm timber roof bracing.

(c) External wall – 102.5mm facing clay brickwork, 75mm cavity with 50mm rigid insulation, inner leaf of solid concrete block-work. Two coat plaster, standard duty top hat cavity lintels to openings. Windows to be full height glazing units.

(d) Internal wall – Allow for proprietary partitioning system to suite proposed tenant internal layout.

Basis of cost calculations

1.51 The two designs, to British Standards and European Standards, both comprise masonry load bearing walls together with pcc suspended decking ground floor and a timber trussed rafter roof structure. The various elements have been quantified for each design with no differences noted. Current market rates have been applied to the quantities to produce element costs for each design. The rates applied to each design remain constant to provide an equal comparison of the differences in quantity of each design.

Cost comparison between British standards and Eurocodes

1.52 Table 1.6 below provides a summary of the total construction costs of a notional single-storey office block under the current standards compared with the costs under the new structural Eurocodes. These figures indicate that there are no differences between the construction costs arising under the British standards and those arising under the structural Eurocodes as they affect AD A.

Table 1.6: Cost summary – single storey office block

Building type	**Construction costs under British Standards (£)**	**Construction costs under Eurocodes (£)**	**Change (£)**	**Change (%)**
Single storey office (masonry and timber)	47,179	47,179	0	0

1.53 A detailed breakdown of the cost components is presented in Appendix 1.

Seven-storey concrete office building

1.54 The specifications for the construction of a notional seven-storey concrete office building are set out below.

Specification assumptions

(a) *Concrete Framework* – All the floor slabs are designed as two way spanning slabs. Beams have been designed as 'T' beams to ensure higher moment capacity but at the interior supports they have been designed as a rectangular section to withstand the hogging moments. Square columns have been designed for all the storeys. Shear walls will resist the lateral forces from wind loads.

(b) *Stability* – Stability is provided by shear walls and they also enclose the lift shafts/staircases. Notional horizontal loads along with the wind loads have been considered in the design of the shear walls. It is ensured that minimum area of reinforcement is provided where ever applicable.

(c) *Location of the building* – The building is located in a small "Business Park" where accidental damage due to vehicle impact is unlikely.

(d) *Basement, foundations & stair cases* – The designs of basements, foundations and stair cases are beyond the scope of this project and hence have not been considered here.

(e) *Wind Loads* – Wind load has been assumed to be 1.1kN/m^2 for the stability analysis. (Note: Detailed calculation of wind load falls outside the scope of this project.)

(f) *Heavy services equipment (Plant)* – All heavy services equipment will be located in the basement (not shown in drawings).

(g) *Floor vibration* – A floor response analysis for vibration due to normal pedestrian traffic (normal walking activities) is considered unnecessary for this building that incorporates stiff two-way concrete slabs.

(h) *Snow Loads* – It is assumed that the building is located in London; hence the snow load on the roof is taken as 0.4 kN/m^2 as per BS 6399-3:1988 and in the case of EC-2, the same is taken as 0.5 kN/m^2.

Basis of cost calculations

1.55 The two designs, to British Standards and European Standards, both comprise a structural reinforced concrete frame together with concrete floor slabs. The various elements have been quantified for each design with small differences noted. Current market rates have been applied to the quantities to produce element costs for each design. The rates applied to each design remain constant to provide an equal comparison of the differences in quantity of each design.

Cost comparison between British standards and Eurocodes

1.56 Table 1.7 below provides a summary of the total construction costs of a notional seven-storey concrete office building under the current standards compared with the costs under the new structural Eurocodes. According to these figures, the cost of construction under the Eurocodes as compared with those under the British standards is slightly cheaper, i.e. £5,607, which in proportional terms, represents only a 0.3 per cent reduction.

Table 1.7: Cost summary – seven-storey concrete office building

Building type	**Construction costs under British Standards (£)**	**Construction costs under Eurocodes (£)**	**Change (£)**	**Change (%)**
Seven-storey concrete office building	1,806,688	1,801,081	-5,607	-0.3

1.57 A detailed breakdown of the cost components is presented in Appendix 1.

Seven-storey steel office building

1.58 The specifications for the construction of a notional seven-storey steel office block are set out below.

Specification assumptions

(a) *Steel framework* – All floor slabs are designed as concrete slabs acting compositely with profiled metal decking. The metal deck is fixed to the top flange of the steel beams with through-deck-welded headed shear studs. All steel beams are designed as composite beams simply supported at both ends. Columns are designed as braced columns in simple construction with only nominal moments to resist at each floor level. All steel beams have been designed to limit the deflection under service load to 40mm, without pre-cambering.

(b) *Stability* – Stability is provided by cross-braced steel frames located in the lift/stairwells. It is assumed that lateral loads are transferred via concrete floor plates acting as diaphragms, to the braced frames.

(c) *Location of the building* – The building is located in a small “Business Park” where accidental damage due to vehicle impact is unlikely.

(d) *Basement and foundations* – The basement and foundation design is not considered here as it falls outside the scope of this project.

(e) *Steel columns* – Steel columns carry all the upper floor loads, ground floor loads and the roof and will continue through the basement to the foundations. These will be concrete encased below the ground floor and will not carry additional loads below the ground level.

(f) *Profiled metal decking* – Profiled metal decking used in the design has been selected based on the load-span tables provided by the manufacturer. Detail design for the decking has not been done.

(g) *Wind Loads* – Wind load has been assumed to be 1.1 kN/m^2 for stability analysis. (Note: Detailed calculation of wind load falls outside the scope of this project.)

(h) *Heavy services equipment (Plant*) – All heavy services equipment will be located in the basement.

(i) *Floor vibration* – A floor response analysis for vibration due to normal pedestrian traffic (normal walking activities) is usually required, but has not been carried out in this design as it falls outside the scope of this project.

(j) *Basis of cost calculations* – The two designs, to British Standards and European Standards, both comprise a structural steel frame together with concrete floor slabs on metal decking. The various elements have been quantified for each design with small differences noted. Current market rates have been applied to the quantities to produce element costs for each design. The rates applied to each design remain constant to provide an equal comparison of the differences in quantity of each design.

Cost comparison between British standards and Eurocodes

1.59 Table 1.8 provides a summary of the total construction costs of a notional seven-storey steel office block under the current standards compared with the costs under the new structural Eurocodes. In contrast to the seven-storey building made using concrete, the estimated construction cost for building a seven-storey office block using steel is slightly more expensive under the Eurocode, i.e. £7350. In proportional terms however, this increase is very small, representing only a 0.4 per cent increase.

Table 1.8: Cost summary – seven-storey steel office building

Building type	**Construction costs under British Standards (£)**	**Construction costs under Eurocodes (£)**	**Change (£)**	**Change (%)**
Seven-storey steel office building	1,682,105	1,689,455	7,350	0.4

1.60 A detailed breakdown of the cost components is presented in Appendix 1.

Implications for disproportionate collapse requirement

1.61 The change from the current AD A requirement on disproportionate collapse to that given in the Eurocodes could potentially give rise to safety implications, although it was not so for the considered buildings. As the scope of this project is too narrow to study this matter in detail to produce conclusive recommendations, we would recommend a detailed study of these aspects be carried out prior to acceptance of the proposed change to the AD A. This study is likely to be a probabilistic risk assessment in relation to the current and proposed requirements for a series of buildings with different geometries.

1.62 Observations on the proposed increase in the limit on floor damage under Disproportionate Collapse Requirements are discussed in detail in Appendix 3:

Aggregation of construction costs for projected new building

1.63 As discussed in Section 1, our approach to aggregating the construction costs for the total projected rate of domestic and non-domestic new builds, involved making assumptions about the average floor size of buildings within each of the categories in order to estimate the average number of new builds per year in each building category. We also made assumptions about the relative building characteristics and the likely cost implication of these in order to make the necessary adjustments to our baseline estimates and assumptions about the distribution of new non-domestic builds according to different materials (i.e. masonry and timber, concrete and steel). Our assumptions on the latter were based on a recent report published by Faber Maunsell (now AECOM)[7] which provided data on the market share of frame structures of multi-story buildings in 2000. These estimates indicated that the market share for masonry and timber, concrete and steel were 12, 20, and 68 per cent respectively. In our estimates of the aggregates construction costs, we have assumed that these shares will remain constant over the period over which we are calculating impacts.

1.64 Table 1.9 and Table 1.10 below, summarise the aggregate number of projected new non-domestic buildings between 2009 and 2019 and the aggregate number of projected new domestic builds per year respectively.

[7] http://www.fabermaunsell.com/media/5263.pdf

Table 1.9: Projected New Non-domestic Buildings (Annually)

	Floor area assumed in energy modelling (m2)*	New build (m2/year)	No. of buildings	68 % steel	20 % concrete	12 % masonry and timber
Office less 1000m2	2,160	133,774	62	42	12	7
Office above 1000 m2	12,500	3,445,041	276	188	55	33
Warehouse (no RL)	600	725,334	1,209	822	241	145
Warehouse (w/ RL)	600	2,176,001	3,627	2,466	725	435
Hotel	1,088	544,095	501	341	100	60
School	384	369,126	961	653	192	115
Retail	600	10,33,192	1,722	1,171	344	206
Supermarket	2,600	193,848	75	51	15	9
Total			**8,433**	**5,734**	**1,687**	**1,012**

**Faber Maunsell modeling estimations*

Source: BRE (data assembled from AIB, CLG and BERR statistics) and Europe Economics calculations

Table 1.10: Projected New Domestic Buildings (Annually)

Building type	Total projected number of new builds
Detached house	37,500
Semi-detached house	27,000
Mid-terrace house	37,500
Flat	48,000

Source: BRE (data assembled from AIB, CLG and BERR statistics)

1.65 Tables 2.10, 2.11 and 2.12 below set out our assumptions in more details and the exact adjustments we have made to our baseline costs estimates (i.e. those estimated for our notional buildings multiplied by the projected number of new builds that correspond to these) for each of the building categories other than those in which the notional buildings fit into.

Table 1.11: Aggregate cost estimates for domestic buildings– Masonry and timber (based on a notional 2-storey detached house)

Build	Construction costs	Projected number of new builds	Total (adjusted) costs under current standards (£million)	Total (adjusted) costs under Eurocode standards (£million)
Detached house	Our notional two-storey detached house would fall into this category. We therefore base our estimates of the aggregate construction costs of other building types (for which new build projections have been made) on this baseline estimate. We assume that on average this type of property would be the most costly to build compared with all of the other categories for which we have projected figures for.	37,500	1,523	1,518
Semi-detached house	We assume that this would represent three quarters of the cost of building a detached house.	27,000	822	820
Mid-terrace house	As above, we assume that this would represent 75 per cent of the cost of building a detached house.	37,500	1,142	1,139
Flat	We assume that this would represent 50 per cent of the cost of building a detached house.	48,000	975	972
TOTAL ANNUAL CONSTRUCTION COSTS			**4,463**	**4,450**

Table 1.12: Aggregate cost estimates for non-domestic buildings– Masonry and timber (based on a notional one-storey office block)

	Construction costs assumptions	Projected number of new builds	Total (adjusted) costs under current standards (£million)	Total (adjusted) costs under Eurocode standards (£million)
Office less 1000m2	Our notional one storey office block would fall into this category. We therefore base our estimates of the aggregate construction costs of other building types (for which new build projections have been made) on this baseline estimate.	7	0.4	0.4
Office above 1000 m2	We assume that office blocks of this size would have two floors at the minimum. As we assume that the floor space of the ground floor level will be the same, we would therefore expect that the same basic structural requirements apply to both types of office block. Thus, we assume that the incremental construction costs of office blocks in this larger category will be proportional to the number of floors above one. We assume that this incremental cost (relative to the total construction cost) will be approximately 10 per cent per additional floor added. We assume that the average number of floors that office blocks have in this category are approximately 4. Using these assumptions, we revise out base estimate cost of a single storey office block upwards by 40 per cent.	33	2.2	2.2
Warehouse with roof lights*	We assume that a typical warehouse will have one story and would approximately be at least twice the size of our notional single story office block. We assume that increasing the base level floor size is likely to have more implications for the structural construction costs than adding one additional floor. We therefore adjust our base estimate of a one storey office bock by 10 per cent to reflect the cost of constructing a warehouse.	145	7.5	7.5

Warehouse without roof lights	We make the same assumptions here as we have above.	435	22.6	22.6
Hotel	We assume a typical hotel would have a larger floor space than 1000 m2 and would have more than 2 floors. We therefore increase our baseline cost by 30 per cent to reflect the difference in the number of floors and a further 10 per cent to account for the larger ground floor space. We therefore increase our baseline estimate by a total of 40 per cent to reflect the construction costs of a typical hotel.	60	39.7	39.7
Primary School	We assume that a typical primary school will have approximately 2 floors and would have a floor space that would on average be approximately 2 times that of a single story office. Based on these assumptions we adjust our baseline estimate by increasing it by 10 per cent to reflect the larger floor size and a further 20 per cent to reflect the additional floors. We therefore increase our baseline estimate by a total of 30 per cent to reflect the cost of building an average primary school.	115	7.1	7.1
Retail Unit	We assume that the building a retail unit would be very similar to that of a one story office block that is smaller than 1000 m2. However, we assume that the average number of floors in a typical retail unit will be approximately 2. Thus, we adjust our baseline estimate upwards by 10 per cent to reflect this difference.	207	10.7	10.7
Supermarket	We assume that with regards to the construction costs we have considered in this impact assessment, the costs of building a supermarket relative to an office block would be similar to that of a warehouse (as described above). Further, while we assume that a majority of new supermarkets built will be in the smaller range (i.e. more are likely to fall in the category of local rather than large superstores), for the purposes of this exercise, we assume that the typical supermarket built will be of a comparable size to that assumed for a typical warehouse (i.e. twice the floor space as a one-	9	0.5	0.5

story office block). We therefore revise our baseline estimate upwards by 10 per cent to reflect the cost of constructing a supermarket.

TOTAL ANNUAL CONSTRUCTION COSTS	**1,012**	**55**	**55**

Table 1.13: Aggregate cost estimates for non-domestic buildings– concrete (based on a notional 7-storey office block)

	Disproportion collapse requirements (concrete)	Projected number of new builds (concrete)	Total (adjusted) costs under current standards (£million)	Total (adjusted) costs under Eurocode standards (£million)
Office less 1000m2	We assume that the incremental cost of constructing an additional floor would be 10 per cent of the total cost of building an office block with one floor. We therefore adjust our baseline estimate by 85.7 per cent.	12	3.2	3.2
Office above 1000 m2	Our notional 7- (steel) storey office block would fall into this category. We therefore base our estimates of the aggregate construction costs of other non-domestic building types (for which new build projections have been made) on this baseline estimate	55	99.7	99.4
Warehouse with roof lights*	In line with our previous assumptions, we revise our baseline cost downwards by 60 per cent to reflect the floor differences and increase this by 10 per cent to reflect in the increase in the floor size of the ground level. We therefore reduce our baseline costs estimate by a total of 75.7 per cent to reflect the construction costs of a warehouse.	242	106	106
Warehouse without roof lights	We make the same assumption as above.	725	3,185	3,175
Hotel	Based on our previous assumptions we revise our baseline cost estimate by 43 per cent to account for the difference in floor levels and increase it by 10 per cent to account for floor space differences. We therefore adjust our baseline estimate by a total of 53 per cent.	100	85.1	84.8

Primary School	Again, we assume that the floor space of the ground level of an typical primary school is larger than that of our notional office block so we account for this in by adjusting our baseline estimate up by 10 per cent. However, as we assume a typical primary school will have on average 2 floors, we revise our baseline estimate downwards by 71 per cent. This makes our total downward adjustment 61 per cent to reflect the average cost of building a primary school.	192	135.4	135.0
Retail Unit	We assume that the building a typical retail unit would be very similar to that of a one story office block with a floor space that it smaller than 1000 m2. Assuming an average retail unit has approximately 2 storeys, we adjust our baseline cost estimate by 71 per cent to reflect the construction cost of building a typical retain unit.	344	180.4	179.9
Supermarket	We assume that with regards to the construction costs we have considered in this impact assessment, the costs of building a supermarket relative to an seven storey office block would be similar to that of a warehouse (as described above). Further, while we assume that a majority of new supermarkets built will be in the smaller range (i.e. more are likely to fall in the category of local rather than large superstores), for the purposes of this exercise, we assume that the typical supermarket built will be of a comparable size to that assumed for a typical warehouse (i.e. twice the floor space as a one-story office block). We therefore revise our baseline estimate upwards by 10 per cent to reflect the cost of constructing a supermarket, but at the same time we also revise it downwards by 85.7 per cent to reflect our assumed differences in the number of floors between a supermarket and seven-storey office block. The combined change is therefore equal a downward revision of 75.7 per cent.	15	6.6	6.6
TOTAL ANNUAL CONSTRUCTION COSTS		**1,687**	**935**	**932**

Table 1.14: Aggregate cost estimates for non-domestic buildings– steel (based on a notional 7-storey office block)

	Disproportion collapse requirements (concrete)	Projected number of new builds (steel)	Total (adjusted) costs under current standards (£million)	Total (adjusted) costs under Eurocode standards (£million)
Office less 1000m2	We assume that the incremental cost of constructing an additional floor would be 10 per cent of the total cost of building an office block with one floor. We therefore adjust our baseline estimate by 85.7 per cent.	42	10.1	10.2
Office above 1000 m2	Our notional 7- (steel) storey office block would fall into this category. We therefore base our estimates of the aggregate construction costs of other building types (for which new build projections have been made) on this baseline estimate.	188	316	317
Warehouse with roof lights*	In line with our previous assumptions, we revise our baseline cost downwards by 60 per cent to reflect the floor differences and increase this by 10 per cent to reflect in the increase in the floor size of the ground level. We therefore reduce our baseline costs estimate by a total of 75.7 per cent to reflect the construction costs of a warehouse.	822	336	338
Warehouse without roof lights	We make the same assumption as above.	2,466	1,008	1,013
Hotel	Based on our previous assumptions we revise our baseline cost estimate by 43 per cent to account for the difference in floor levels and increase it by 10 per cent to account for floor space differences. We therefore adjust our baseline estimate by a total of 53 per cent.	341	269	271

Primary School	Again, we assume that the floor space of the ground level of an typical primary school is larger than that of our notional office block so we account for this in by adjusting our baseline estimate up by 10 per cent. However, as we assume a typical primary school will have on average 2 floors, we revise our baseline estimate downwards by 71 per cent. This makes our total downward adjustment 61 per cent to reflect the average cost of building a primary school.	653	429	431
Retail Unit	We assume that the building a typical retail unit would be very similar to that of a one story office block with a floor space that it smaller than 1000 m2. Assuming an average retail unit has approximately 2 storeys, we adjust our baseline cost estimate by 71 per cent to reflect the construction cost of building a typical retain unit.	1,171	571	574
Supermarket	We assume that with regards to the construction costs we have considered in this impact assessment, the costs of building a supermarket relative to an seven storey office block would be similar to that of a warehouse (as described above). Further, while we assume that a majority of new supermarkets built will be in the smaller range (i.e. more are likely to fall in the category of local rather than large superstores), for the purposes of this exercise, we assume that the typical supermarket built will be of a comparable size to that assumed for a typical warehouse (i.e. twice the floor space as a one-story office block). We therefore revise our baseline estimate upwards by 10 per cent to reflect the cost of constructing a supermarket, but at the same time we also revise it downwards by 85.7 per cent to reflect our assumed differences in the number of floors between a supermarket and seven-storey office block. The combined change is therefore equal a downward revision of 75.7 per cent.	51	21	219
TOTAL ANNUAL CONSTRUCTION COSTS		**5,734**	**2,960**	**2,973**

Summary of impacts on construction costs

1.66 Table 1.15 below provides a summary of the comparison between the aggregate construction costs of the projected new building under the British standards and those incurred under Eurocodes. It can be seen that overall there is no significant difference in the construction costs. The Eurocodes are expected to provide a net reduction in construction costs of approximately £40 million (NPV over forty years).

Table 1.15: Summary of impacts on yearly construction costs

Building type (based on material used)	Aggregate construction costs under British Standards (£million)	Aggregate construction costs under Eurocodes (£million)	Difference (£million)	Difference (%)	20 year NPV (£million)
		Projected new domestic buildings			
Masonry and timer	4,463	4,450	-13	-0.3	-187.0
		Projected new non-domestic buildings			
Masonry and timber	55	55	0	0.0	-0.1
Steel	2,960	2,973	13	0.4	190.2
Concrete	935	932	-3	-0.3	-42.7
TOTAL	**8,413**	**8,411**	**-3**	**0.0**	**-40**

Source: Scott Wilson and Europe Economics calculations

1.67 We note that these estimates (in absolute terms), particularly for the non-domestic categories, are particularly sensitive to the assumptions we have made in relation to the proportion of projected new builds that will be built using masonry and timber, concrete and steel. However, given the differences in the expected construction costs (in absolute terms) arising under the British compared with the Eurocodes standards are so small, the *relative* changes in costs will not be very sensitive to changes made with regards to the aggregate number of new buildings within each of the above categories.

Enforcement costs

1.68 There are two principle types of enforcement costs that Building Control Bodies (BCBs), i.e. those responsible for the enforcement of building standards, would be expected to incur:[8]

(a) One-off enforcement costs; and

(b) Ongoing enforcement costs.

8 BCBs can be either local authorities or Approved Inspectors (AIs).

Transition costs of enforcement

1.69 With regard to the one-off costs of enforcement, similar to building structure designers, building inspectors would also be expected to familiarise themselves with the Eurocodes in order to be able to verify upon inspection that new buildings comply with the new codes. We refer to similar calculations employed for the 2008 CLG Impact Assessment of Building Regulation Part G.[9]

1.70 Table 1.16 below provides a summary of the key one-off costs relevant (per building inspector) that BCBs can be expected to occur as a result of adopting the Eurocodes.

Table 1.16: Estimate of the one-off cost to Local Authorities/Approved Inspectors of re-training building inspectors from adopting the Eurocodes

Calculation	Amount
Total employed in BCBs across England and Wales	4,000
Approximate cost of training member of organisation*	£140
TOTAL	**£560,000**

** Note that this is likely to vary between £100 and £300. Larger organisations with economies of scale are likely to have lower training costs etc.*

Source: CLG, 2008

1.71 The above figures indicate that the one-off costs to BGBs would be £560,000.[10]

Ongoing costs of enforcement

1.72 The introduction of the Eurocodes will replace the British Standards rather than complement them and thus different things (to the extent that the Eurocodes differ from the current standards) will have to be checked in the inspection process rather than more things. This therefore implies that once inspectors have become familiarized with the Eurocodes they would not be required to spend any more time inspecting buildings than they do under the current system. We therefore expect that the incremental yearly costs of enforcement under the Eurocodes will be zero.

Summary of Cost/Benefit Analysis

1.73 In conclusion we expect the implementation of the Eurocodes to have a significant net cost to professional firms in England and Wales, in particular on the Construction Industry. Benefits derived from the building costs saved by adhering to the Eurocodes, are

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9 Communities and Local Government (2008) “Consultation on: The Building Act 1984, The Building Regulations 2000: Impact Assessment of Amending Part G (Hygiene) of the Building Regulations and the Revision to Approved Document G Impact Assessment.” http://www.communities.gov.uk/documents/planningandbuilding/pdf/partgimpact.doc.

10 We note that the 2008 Part G Impact Assessment also makes mention of the best practice recommendation for employers to spend at least 1% of their wage bills on training. Following this rule of thumb would imply that employers in the construction industry spend at least £7.5 million on training actually. Europe Economics does not go so far as to endorse this as we feel it would be outside the remit of the Impact Assessment.

projected to be approximately £20 million over the next 20 years (NPV) — with 20 years being the average life of a building before it requires significant infrastructural refurbishment. Near term one-off costs to industry of acquainting themselves through training and education and of enforcement of the codes through re-training by BCBs will range from £118.6 - £178.1 million in the period covering 2010 and 2011.[11]

Statutory Impact Test (Race, Gender, Disability)

Equalities assessments

1.74 There is a statutory duty to consider the impact of a policy on race, disabilities and gender equality.

1.75 The policy would affect all parties the same regardless of race, gender and disability.

1.76 The impacts of the forthcoming changes in this area will be negligible. More specifically:

(a) the proposed policy will not have a negative impact on any racial or gender groups;

(b) the proposed policy would have the same effect on all parties regardless of disabilities; and

(c) There would not be any impact on human rights.

Other Specific Impact Tests

Impacts on competition

1.77 According to the Office of Fair Trading (OFT) competition assessment guidance[12] when analysing competition impacts the following questions should be addressed:

(a) In any affected market would the proposal:

(b) Directly limit the range of supplier?

(c) Indirectly limit the number or range of suppliers?

(d) Limit the ability of suppliers to compete?

(e) Reduce suppliers' incentives to compete vigorously?

1.78 The principal markets affected by the policy are those for the development of new buildings and the production of construction materials used in those developments.

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11 Assuming costs are distributed equally between the two year period, we discount the second-year costs by 3.5%, as prescribed in

1.79 We estimate that the reasons for the observed cost differences between Eurocode and BS designs of each building are as follows:

(a) 2-Storey Domestic House – Larger quantity of roof purlins used to satisfy the requirements of the BS design.

(b) Single Storey Office Building – No difference in cost observed.

(c) 7-Storey RC Frame Office Building – the two key reasons for observed cost differences were as follows:

- Slabs: The differences in slab thickness and amount of steel reinforcement in the ground floor slab, upper floor slabs and the roof slab to satisfy the requirements of the BS and Eurocodes.

- Columns: The differences in (cross section) dimensions and amount of steel reinforcement to satisfy the requirements of the BS and Eurocodes.

(d) 7-Storey Steel Frame Office Building – Columns**:** Larger steel column sections used to satisfy requirements of the Eurocode design.

Directly limit the range of suppliers?

1.80 In theory, the proposal could limit the range of suppliers of construction materials if they required a particular specification of construction material to be used which could only be produced by a proportion of the current range of suppliers. This might lead to suppliers producing low specification materials exiting the market and hence a higher market concentration amongst the remaining suppliers.

1.81 However, in practice this is not likely to hold as the structural Eurocodes do not dictate which materials should be used for a particular building, and thus, construction firms will continue to have very similar levels of discretion over which particular materials they choose to source as they do under the current system. The limited need to alter which materials are sourced is further reinforced by the existence of the National Annex which does allow for some discretion over how the new codes will be applied in practice. This in turn, would suggest that this proposal will have negligible impacts on limiting the current range of suppliers in the UK market.

1.82 Further, by having standardised building codes throughout the EU, this proposal might in fact increase the range of suppliers of construction material to the extent that European suppliers can enter the UK market (we assume here that there are no large entry barriers to this market) offering for example, more innovative and/or efficient materials.

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the HM Treasury Greenbook.

12 OFT – Completing competition assessments in Impact Assessments, guidance for policy makers, August 2007, OFT876.

Indirectly limit the number or range of suppliers?

1.83 On the basis of our above discussion, we do not believe there will be any direct impacts on limiting the supplier range on the UK construction market. We do not therefore expect that there will be any indirect impacts on limiting the supplier range in the UK as a result of this proposal either.

Limit the ability of suppliers to compete?

1.84 A policy may limit the ability of suppliers to compete, for example, by limiting the price that they may charge or the characteristics of the product supplied, e.g. by setting minimum quality standards.

1.85 In this particular case however, the introduction of the structural Eurocodes will not have a significantly adverse effect on the ability of UK suppliers, construction companies and structural designers to compete on both the UK and foreign markets.

1.86 On the one hand, the proposal might limit the possibility of competing to the extent that all in the industry have to comply with the same codes with negligible flexibility in being able to innovate. Assessing the specific extent to which this might impact on the ability of UK firms to compete effectively for projects at home and abroad is outside the scope of this impact assessment as this would require a detailed knowledge not only of how the variations set out in the UK Annex compare to those set out in the other Member States' annexes, but also of how each variation might or might not confer a competitive advantage upon UK firms. However, this potential reduction in competition is unlikely yo happen as the majority of Eurocodes regard the design of buildings rather than the materials to be used in construction.

1.87 Further, those firms that have taken a proactive stance in implementing the new systems and undertaking the training in order comply with the forthcoming Eurocodes, may in fact be more able to compete than those who have yet to fully adapt. In practice however, this is only likely to apply to a small proportion of players (i.e. mainly the larger companies) as anecdotal evidence on this issue suggest that most firms have yet to implement the Eurocodes.

Reduce suppliers' incentives to compete vigorously?

1.88 We do not expect that this proposal will have a negative impact of the ability of players in this industry to compete vigorously. On the contrary, by increasing the scope for new foreign players to enter the market (i.e. by increasing the contestability of the industry) the proposal should enhance the incentives of UK industry players to compete rather than mute them in any way.

Overall competition impact

1.89 To summarise, we expect that this proposal will have no adverse effect on the range of suppliers in the industry (neither directly nor indirectly), the ability of firms to compete nor the rigour which with which they currently complete.

Small firms impact test

1.90 The small firms impact test regards all firms with less than 50 full time employees as being small businesses. The majority of small firms have fewer than 10 employees and guidelines state that a concerted effort should be made to consult them over policy proposals.

1.91 The UK construction industry is dominated by small firms. Over 99 per cent of the around 980,000 enterprises in the construction sector in 2007, were small firms[13] with the majority being classified as sole proprietorships. In 2007 small firms accounted for 75 per cent of construction sector employment and over 54 per cent of industry turnover.

1.92 Parties affected by the proposals would include small firms involved in the construction of buildings and in the materials used in construction.

1.93 There are a number of ways in which small firms may be disproportionately affected by the proposals when compared to how larger firms are affected, for example, it may be harder for small firms to alter their design process or cost more for them to train individual members of staff.

1.94 In order to explore the issues facing smaller firms, we carried out interviews with representatives from three small firms involved in the construction trade and with one trade association.

Familiarity with the provisions of the Eurocodes

1.95 Generally respondents were not fully familiar with the provisions of the Eurocodes and did not think that they were sufficiently clear. One respondent stated that it was especially difficult for smaller companies on their own to understand them and that small firms might have to spend money to get them interpreted. Another respondent said that there seemed to be inconsistency between the BS standards and those of the Eurocodes, with Eurocodes sometimes being much stricter and sometimes much more lax.

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[13] BERR statistics http://stats.berr.gov.uk/ed/sme/smestats2007.xls#'UK Whole Economy'!A1
Small firms defined as firms employing less 50 employees, including sole traders.

Costs and benefits of fulfilling the Eurocodes

1.96 All respondents thought that the costs of fulfilling the Eurocodes would be relatively high when compared to the potential benefits. The main cost would be the cost of training staff and the loss of productive time associated with this, although buying the Eurocodes would also be a significant cost. There might also be additional design costs associated with using the Eurocodes.

1.97 Training cost estimates varied from £5,000 - £25,000 to train each engineer to use the Eurocodes. Costs would vary according to how many Eurocodes each engineer was required to use and be familiar with.

1.98 The cost of buying the Eurocodes was estimated at around £160/180 per Eurocode. It was suggested that firms would need to purchase at least 12 of these but few would need to purchase all 58 parts.

1.99 One respondent said that using the Eurocodes took longer and that the end product could cost about 10 per cent more to make. However, other respondents suggested that costs for some structures would in fact be lower, with a saving of around 5 per cent for some buildings. This is in line with our estimates presented above, although the 10 per cent increase in costs seems particularly high.

1.100 It was generally thought that increased opportunities in terms of it being easier to compete abroad would be unlikely to accrue to small firms. It was pointed out that most small firms tend to work in a 30 mile radius of their locality and that to compete abroad there would also be other requirements (such as particular certifications, etc) which small firms would be unlikely to have.

1.101 There might, however, be increased opportunities for larger firms who either already operated overseas or had the capacity to do so. It was also thought that the Eurocodes would lead to more opportunities for overseas contractors to work in the UK.

Overall small firm impact

1.102 There are likely to be costs resulting from the implementation of the Eurocodes, both in terms of training staff and in purchasing the Eurocodes. There may also be some increased construction costs associated with using them. Training costs are likely to impact more on smaller firms because they do not have the economies of scale available to larger firms.

1.103 The benefits accruing from the Eurocodes such as increased ability to compete abroad are less likely to accrue to small firms than larger firms as small firms tend to work more locally.

Legal aid

1.104 The forthcoming changes would have no impact on Legal Aid.

APPENDIX 1: DETAILED CONSTRUCTION COST BREAKDOWN

Two-Storey Detached House

Figure A1. 1: Detailed construction costs under British standards

SCOTT WILSON LTD

Cost Comparison Exercise
British Standards vs Eurocodes

28th April 2009

British Standards

2 Storey Domestic House

Ground floor					
150mm thick pcc beam & block floor	100	m2	35.00	3,500	
40mm thick floor insulation	100	m2	15.00	1,500	
75mm thick cement & sand screed	100	m2	12.00	1,200	6,200
External walls					
102.5mm thick facing brick wall	220	m2	50.00	11,000	
Form cavity	220	m2	2.00	440	
50mm thick insulation	220	m2	5.00	1,100	
100mm thick concrete blockwork	220	m2	25.00	5,500	
Lintels / dpc's sundries etc	1	Item	1,800.00	1,800	19,840
Internal walls					
100mm thick concrete blockwork	122	m2	25.00	3,050	
Lintels / dpc's sundries etc	1	Item	300.00	300	3,350
Upper floors					
200 x 50mm floor joist	260	m	6.00	1,560	
50 x 50mm strutting	20	m	7.50	150	
19mm t & g boarding	100	m2	20.00	2,000	
Restraint straps	16	Nr	8.00	128	
Sundries	1	Item	150.00	150	3,988
Pitched roof					
150 x 50mm rafters	281	m	5.00	1,405	
225 x 50mm purlins	40	m	6.50	260	
75 x 75mm props	15	m	4.50	68	
200 x 50mm ceiling joists	260	m	6.00	1,560	
100 x 50mm wall plate	20	m	8.00	160	
125 x 25mm bracing	50	m	3.00	150	
Restraint straps	32	Nr	8.00	256	
Rigid insulation	100	m2	12.00	1,200	
Sundries	1	Item	250.00	250	5,309
					38,687
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	1,934
Total Cost To Summary					£40,621

Source: Scott Wilson

Figure A1. 2: Detailed construction costs under Eurocodes

Eurocodes

2 Storey Domestic House

Ground floor					
150mm thick pcc beam & block floor	100	m2	35.00	3,500	
40mm thick floor insulation	100	m2	15.00	1,500	
75mm thick cement & sand screed	100	m2	12.00	1,200	6,200
External walls					
102.5mm thick facing brick wall	220	m2	50.00	11,000	
Form cavity	220	m2	2.00	440	
50mm thick insulation	220	m2	5.00	1,100	
100mm thick concrete blockwork	220	m2	25.00	5,500	
Lintels / dpc's sundries etc	1	Item	1,800.00	1,800	19,840
Internal walls					
100mm thick concrete blockwork	122	m2	25.00	3,050	
Lintels / dpc's sundries etc	1	Item	300.00	300	3,350
Upper floors					
200 x 50mm floor joist	260	m	6.00	1,560	
50 x 50mm strutting	20	m	7.50	150	
19mm t & g boarding	100	m2	20.00	2,000	
Restraint straps	16	Nr	8.00	128	
Sundries	1	Item	150.00	150	3,988
Pitched roof					
150 x 50mm rafters	281	m	5.00	1,405	
225 x 75mm purlins	20	m	10.00	200	
75 x 75mm props	15	m	4.50	68	
200 x 50mm ceiling joists	260	m	6.00	1,560	
100 x 50mm wall plate	20	m	8.00	160	
125 x 25mm bracing	50	m	3.00	150	
Restraint straps	32	Nr	8.00	256	
Rigid insulation	100	m2	12.00	1,200	
Sundries	1	Item	200.00	200	5,199
					38,577
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	1,929
Total Cost To Summary					£40,505

Source: Scott Wilson

One-Storey Office Block

Figure A1. 3: Detailed construction costs under British standards

SCOTT WILSON LTD

Cost Comparison Exercise
British Standards vs Eurocodes

28th April 2009

British Standards

Single Storey Office Building

Ground floor					
150mm thick pcc beam & block floor	200	m2	35.00	7,000	
40mm thick floor insulation	200	m2	15.00	3,000	
75mm thick cement & sand screed	200	m2	12.00	2,400	12,400
External walls					
102.5mm thick facing brick wall	220	m2	50.00	11,000	
Form cavity	220	m2	2.00	440	
50mm thick insulation	220	m2	5.00	1,100	
200mm thick concrete blockwork	220	m2	45.00	9,900	
Lintels / dpc's sundries etc	1	Item	2,000.00	2,000	24,440
Pitched roof					
Trussed rafter, 25 degrees; 10m clear span	34	Nr	125.00	4,250	
100 x 50mm wall plate	40	m	8.00	320	
125 x 25mm bracing	200	m	3.00	600	
Restraint straps	34	Nr	8.00	272	
Rigid insulation	200	m2	12.00	2,400	
Sundries	1	Item	250.00	250	8,092
					44,932
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	2,247
Total Cost To Summary					£47,179

Source: Scott Wilson

Figure A1. 4: Detailed construction costs under Eurocodes

Eurocodes

Single Storey Office Building

Ground floor					
150mm thick pcc beam & block floor	200	m2	35.00	7,000	
40mm thick floor insulation	200	m2	15.00	3,000	
75mm thick cement & sand screed	200	m2	12.00	2,400	12,400
External walls					
102.5mm thick facing brick wall	220	m2	50.00	11,000	
Form cavity	220	m2	2.00	440	
50mm thick insulation	220	m2	5.00	1,100	
200mm thick concrete blockwork	220	m2	45.00	9,900	
Lintels / dpc's sundries etc	1	Item	2,000.00	2,000	24,440
Pitched roof					
Trussed rafter, 25 degrees; 10m clear	34	Nr	125.00	4,250	
100 x 50mm wall plate	40	m	8.00	320	
125 x 25mm bracing	200	m	3.00	600	
Restraint straps	34	Nr	8.00	272	
Rigid insulation	200	m2	12.00	2,400	
Sundries	1	Item	250.00	250	8,092
					44,932
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	2,247
Total Cost To Summary					£47,179

Source: Scott Wilson

Seven Storey Concrete Office Block

Figure A1. 5: Detailed construction costs under British standards

SCOTT WILSON LTD

Cost Comparison Exercise
British Standards vs Eurocodes

28th April 2009

British Standards

7 Storey RC Frame Office Building

Ground floor					
275 mm thick RC floor	434	m3	110.00	47,740	
Cast onto dpm and formation by others					
Reinforcement	33.5	T	900.00	30,150	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	82,390
Structural frame					
Concrete columns	113	m3	150.00	16,950	
Reinforcement to columns	34	T	900.00	30,600	
Formwork to columns	1025	m2	40.00	41,000	
Concrete attached to beams	896	m3	140.00	125,440	
Reinforcement to beams	216	T	900.00	194,400	
Formwork to beams	4480	m2	45.00	201,600	
Concrete shear walls	306	m3	125.00	38,250	
Reinforcement to walls	25	T	900.00	22,500	
Formwork to walls	2450	m2	35.00	85,750	756,490
Upper floors					
275mm thick RC floors	2351	m3	110.00	258,610	
Reinforcement	181	T	900.00	162,900	
Formwork to soffit	8550	m2	35.00	299,250	
Formwork to edges	1200	m	20.00	24,000	
Holes etc	1	Item	3000.00	3,000	747,760
Flat roof					
250mm thick RC floor	394	m3	110.00	43,340	
Reinforcement	34.5	m3	900.00	31,050	
Formwork to soffit	1575	m2	35.00	55,125	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	134,015
					1,720,655
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	86,033
Total Cost To Summary					£1,806,688

Source: Scott Wilson

Figure A1. 6: Detailed construction costs under Eurocodes

Eurocodes

7 Storey RC Frame Office Building

Ground floor					
250mm thick RC floor	395	m3	110.00	43,450	
Cast onto dpm and formation by others					
Reinforcement	38	T	900.00	34,200	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	82,150
Structural frame					
Concrete columns	148	m3	150.00	22,200	
Reinforcement to columns	21	T	900.00	18,900	
Formwork to columns	1178	m2	40.00	47,120	
Concrete attached to beams	896	m3	140.00	125,440	
Reinforcement to beams	203	T	900.00	182,700	
Formwork to beams	4480	m2	45.00	201,600	
Concrete shear walls	306	m3	125.00	38,250	
Reinforcement to walls	25	T	900.00	22,500	
Formwork to walls	2450	m2	35.00	85,750	744,460
Upper floors					
250mm thick RC floors	2138	m3	110.00	235,180	
Reinforcement	204	T	900.00	183,600	
Formwork to soffit	8550	m2	35.00	299,250	
Formwork to edges	1200	m	20.00	24,000	
Holes etc	1	Item	3000.00	3,000	745,030
Flat roof					
225mm thick RC floor	355	m3	110.00	39,050	
Reinforcement	50	m3	900.00	45,000	
Formwork to soffit	1575	m2	35.00	55,125	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	143,675
					1,715,315

Sub-contractor preliminaries	Incl	
Sub-contractor OH&P	Incl	
Contingencies	5%	85,766
Total Cost To Summary		£1,801,081

Source: Scott Wilson

Seven Storey Steel Office Block

Figure A1. 7: Detailed construction costs under British standards

SCOTT WILSON LTD

Cost Comparison Exercise
British Standards vs Eurocodes

28th April 2009

British Standards

7 Storey Steel Frame Office Building

Ground floor					
130mm thick RC floor	1,575	m2	20.00	31,500	
Comflor 51 metal decking	1,575	m2	22.00	34,650	
Extra; back propping	N/A				
A252 mesh fabric	1,575	m2	6.00	9,450	
Transverse reinforcement, 40kg/m3	205	m3	35.00	7,166	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	87,266
Structural frame					
Steel stanchions	93	T	1,400.00	130,200	
Steel beams	436	T	1,400.00	610,400	
Steel roof beams	63	T	1,400.00	88,200	
Steel bracings	21	T	2,000.00	42,000	870,800
Upper floors					
130mm thick RC floor	9,450	m2	20.00	189,000	
Comflor 51 metal decking	9,450	m2	22.00	207,900	
Extra; back propping	9,450	m2	3.00	28,350	
A252 mesh fabric	9,450	m2	6.00	56,700	
Transverse reinforcement, 40kg/m3	1,229	m3	35.00	42,998	
Formwork to edges	1,200	m	20.00	24,000	
Holes etc	1	Item	3,000.00	3,000	551,948
Flat roof					
130mm thick RC floor	1,575	m2	20.00	31,500	
Comflor 51 metal decking	1,575	m2	22.00	34,650	
Extra; back propping	1,575	m2	3.00	4,725	
A252 mesh fabric	1,575	m2	6.00	9,450	
Transverse reinforcement, 40kg/m3	205	m3	35.00	7,166	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	91,991
					1,602,005
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	80,100
Total Cost To Summary					£1,682,105

Source: Scott Wilson

Figure A1. 8: Detailed construction costs under Eurocodes

Eurocodes

7 Storey Steel Frame Office Building

Ground floor					
130mm thick RC floor	1,575	m2	20.00	31,500	
Comflor 51 metal decking	1,575	m2	22.00	34,650	
Extra; back propping	N/A				
A252 mesh fabric	1,575	m2	6.00	9,450	
Transverse reinforcement, 40kg/m3	205	m3	35.00	7,166	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	87,266
Structural frame					
Steel stanchions	98	T	1,400.00	137,200	
Steel beams	436	T	1,400.00	610,400	
Steel roof beams	63	T	1,400.00	88,200	
Steel bracings	21	T	2,000.00	42,000	877,800
Upper floors					
130mm thick RC floor	9,450	m2	20.00	189,000	
Comflor 51 metal decking	9,450	m2	22.00	207,900	
Extra; back propping	9,450	m2	3.00	28,350	
A252 mesh fabric	9,450	m2	6.00	56,700	
Transverse reinforcement, 40kg/m3	1,229	m3	35.00	42,998	
Formwork to edges	1,200	m	20.00	24,000	
Holes etc	1	Item	3,000.00	3,000	551,948
Flat roof					
130mm thick RC floor	1,575	m2	20.00	31,500	
Comflor 51 metal decking	1,575	m2	22.00	34,650	
Extra; back propping	1,575	m2	3.00	4,725	
A252 mesh fabric	1,575	m2	6.00	9,450	
Transverse reinforcement, 40kg/m3	205	m3	35.00	7,166	
Formwork to edges	200	m	20.00	4,000	
Holes etc	1	Item	500.00	500	91,991
					1,609,005
Sub-contractor preliminaries				Incl	
Sub-contractor OH&P				Incl	
Contingencies				5%	80,450
Total Cost To Summary					£1,689,455

Source: Scott Wilson

APPENDIX 2: COMMENTS ON EUROCODES RELATED CHANGES TO AD A AND AD C

Figure A2. 1: Comments on Eurocode related changes to AD C

	Section and paragraph	Nature of suggested change	Content area changed	Type of impact	Comments by Scott Wilson
	"Use of guidance"	replacements	On obligations to follow ADs	Eurocode-driven	
AD A		addition	How to use this AD	clarification/revision	
		deletion	CE marking/Eurocodes	clarification/revision	
		move	Second Technical Specs paragraph	clarification/revision	
		addition and deletion	Reference to Regulation 7	Eurocode-driven (?)	This could increase costs of organisations which do not do have good quality control and workmanship. It is unlikely to affect the costs of organisations which have this good practice, except when it is necessary to set up and administrate this as a formal scheme. Overall, there could be cost benefits with lower levels of reactive maintenance and risks from poor performance. Also, the country's econonomy could benefit through a better reputation for the quality of work of the UK's professionals. This can help to make true the assumption in Eurocodes about the use of designers with appropriate skills.
		addition	Competency and responsibilities, Construction (design and management)	administrative	This could increase costs of organisations which do not do have good quality control and workmanship. It is unlikely to affect the costs of organisations which have this good practice, except when it is necessary to set up and administrate this as a formal scheme. Overall, there could be cost benefits with lower levels of reactive maintenance and risks from poor performance. Also, the country's econonomy could benefit through a better reputation for the quality of work of the UK's professionals. This can help to make true the assumption in Eurocodes about the use of designers with appropriate skills. It can help to focus the attention of a designer to all relevant undesirable events that could occur during the life of a structure.
		addition	Basements	administrative	
		deletion	Eurocodes announcement	clarification/revision	
		addition	Malicious Actions	economic, social	
	"Guidance", 0.2	comment	reference to "Peter Watt email comment"	?	
	0.2a	addition	Identification of hazards	clarification/revision	
	0.2b	addition	Loadings (with reference to Eurocodes)	clarification/revision	The UK's National Annexes should be expected to not change loads to values detrimental to the UK economy or accepted safety levels. Some National Annexes and Parts of EN1991 are still being discussed in BSI Committee and, thus, the final outcome cannot be predicted at present. In the Approved Document A, there needs to be consistency in language either retaining the original British Standard wording or adopting the new Eurocode wording. Provide a glossary/definition of meanings. Eg actions versus load/loads/loading.
	0.2e	addition	Factors of safety	clarification/revision	
	0.2f	addition	The word "actions"	clarification/revision	There needs to be consistency in language either retaining the original British Standard wording or adopting the new Eurocode wording. Provide a glossary/definition of meanings. Eg actions versus load/loads/loading.
		addition	Eurocodes	clarification/revision	
	0.3	addition	Grandstands	clarification/revision	
		deletion	Grandstands	clarification/revision	
	0.4	addition	Application requirement	administrative	
	0.5	addition	Conservatories	clarification/revision	
	0.6	addition	Robust design requirement	administrative	
	Section 1, Introduction	deletion	First sentence	clarification/revision	
	References	addition	Eurocodes referred to	clarification/revision	EC1-7:2006 4.1 (2)requires that actions due to impact shall be taken into accout for buildings that are located adjacent to roads. However British codes do not define this speficially, although this issue is generally considered and dealt with by various means in designing buildings next to roads. As per British codes, it is possible that columns next to a road being ended up designed as "key elements". However, if designed to the impact loads given in EC1-7, the resultant column sizes would probably be greater.

	1.2-1.8	replacements	BS and Eurocodes	clarification/revision	There needs to be consistency in language either retaining the original British Standard wording or adopting the new Eurocode wording. Provide a glossary/definition of meanings. Eg actions versus load/loads/loading.
	1.9	comment	Link to Part C	clarification/revision	
		comment	Updating reference to Guidance Note	clarification/revision	
	Section 2, 2.1	addition	"and robustness"	clarification/revision	
		addition	"Snow loads."	clarification/revision	
	2.3	comment	Placement of definitions	clarification/revision	
		additions and deletions	Definition of terms	clarification/revision	
	2A2	addition	"and robust"	clarification/revision	
	2A2d	replacement	BS code change	Eurocode-driven	EN 1995 provides less information regarding the design and implimentation of roof bracing. BS 5268 - 3 specifically for trussed rafter roofs contains more information and direction. The proposed changes are unlikely to change the current construction costs.
	2B	addition	"Snow loading" in title	clarification/revision	
	2BX	addition	Snow loading requirements	economic, environmental	
	Diagram X	comment	Redo table	clarification/revision	
	2C	addition	Clarification, Eurocode reference	Eurocode-driven	As BS EN 1996-1 is given only as an alternative, there cannot be cost implications imposed by this addition.
	2C1	comment	Formatting	clarification/revision	
	2C4	comment	Section moved up	clarification/revision	
	2C3c	replacement	BS code change	Probably Eurocode-driven; need to confirm	The effects of this change cannot be assessed as the referred to PD is not available yet. Why specifically mention the PD? Is the EN 1996 not adequate?
	2C3e	replacement	BS code change	Probably Eurocode-driven; need to confirm	The effects of this change cannot be assessed as the referred to PD is not available yet. Why specifically mention the PD? Is the EN 1996 not adequate?
	2C6	comment	Numerical consistency	clarification/revision	
	2C7	comment	Numerical consistency	clarification/revision	
	2C8	deletion	Cavity walls in coursed brickwork or blockwork	economic, social	
		comments	Presumably do not apply to deleted materials; should confirm	economic, social	
	2C13	addition	Minimum thickness requirement	economic, social	
	After 2C10	comments	Needs to refer to extensions, not garages	economic, social	
	2C11	comment	"Paragraph should be reviewed."	clarification/revision	
	2C17	replacement	BS code change	Eurocode-driven	On the basis of the scenario that we examined (for a two storey domestic house), the calculated wind loads are similar. Eurocode is tending to give lower peak pressures for the considered scenario, therefore likely that structures maybe slightly more economical, however other factors may govern member sizes. This is based on a comparison of unfactored pressures using the single location we have considered. We have not considered the effect of partial safety factors and combination factors on the overall design situation as the scope of this project was too narrow to express a comprehensive opinion.
		comment	clarify Eurocode cross-reference in maps	clarification/revision	Eurocode maps are contained in the national annex. The Eurocode is based on 10 min mean and the BS based on hourly mean, so the numerical values might be expected to be 5-10% higher for the Eurocodes. The map of basic wind speed is very similar to the current map in BS6399 Part 2, however does give generally higher wind speeds, notably in the north and west of the country. Therefore the areas most likely to be affected by the change are the North of England and Scotland, Wales and the South West of England.
	2C20	deletion	BS codes	Eurocode-driven	BS 5268 has already been updated to reflect EN standards for wall ties. No additional implications from the new EN are foreseen.
		addition	BS code change	Probably Eurocode-driven; need to confirm	

		comment	Possible removal of 2C19 and 20	clarification/revision	
	2C21	addition	BS codes	Eurocode-driven	A random review of UK manufacturers suggests products are currently manufactured to the EN standards noted. No additional implications from the new EN are foreseen.
	2C22	comment	Include wall ties in diagram	clarification/revision	There is no change to the EN compressive strength requirements noted in the current AD-A. The national annex takes care of execution material factors.
	Diagram 7	comment	Change title	clarification/revision	
	Table 5	addition	Revision	clarification/revision	This change is to reflect EN only. No impact on design.
		comment	Review wall ties	economic, social	
	Diagram 10	comment	Revision	clarification/revision	
	2C24	comment	Needs more advice	economic, social	
	2C25b	comment	Revise diagram	clarification/revision	
	Diagram 11	comment	Revise diagram	uncertain	
	2C27	addition	Buttressing walls	economic, social	
	Diagram 13	comment	Change dimension requirement	Eurocode-driven	This is a clarification of the diagram only. There is a note on the diagram that calls for the buttressing wall height to provide support to the full height of the supported wall.
	Diagram 14	comment	Change table reference	clarification/revision	
	Addition by Scott Wilson	2C36 refers to BS EN 845-1 and BS 5628-1			No change to diagram content. Simply updating to EN. (We have not reviewed EN 845 for this project. As these have been around for a while, we believe they were similar to BS)
	2C37	comment	Add reference to diagram	clarification/revision	
	Addition by Scott Wilson	2C39-h still refers to to BS 5268-3			
	Diagram 16	comments	Diagram needs reviewing	uncertain	
	Diagram 19	comment	Change reference	clarification/revision	
	2D	comment	Add text to title	clarification/revision	
	H	comment	Insert cross-reference	clarification/revision	
	2E2	comment	Provisions require revision	economic, social, environmental	There should be a reference here to EN 1992 for concrete and EN 1997 for geotechnical.
	2E2b	deletion	BS code	Eurocode-driven	
	2Eg	addition	flood risk consideration	clarification/revision	
	2E3	comment	Section requires revision, and references	economic, social, environmental	
		addition	References	clarification/revision	
	2E4	addition	Depth of strip foundations	clarification/revision	
	2F	addition	Retaining and freestanding walls	economic, social	
		comment	"Check titles"	clarification/revision	
	Section 3	comment	Re-structuring section	clarification/revision	
	3.1	addition	Addition of "window frames"	economic, social	
		comment	Needs to encompass other window frames	economic, social	
	3.3	addition	Use of word "actions"	clarification/revision	
		addition	Use of word "actions"	clarification/revision	
		addition	BS code change	Eurocode-driven	In a similar manner to that for whole building stability, local pressures are similar in both cases and therefore there is unlikely to be an adverse effect in terms of safety and economy.
		addition	Height specification	(What is counterfactual?)	
	3.9	comment	More detail on glass required	clarification/revision	
		addition	added references	clarification/revision	
	3.10	addition	added references	clarification/revision	
	3.7	addition	Fixings and connectors	administrative	
		comment	Take into account published paper	uncertain	
		deletion	Anchors	clarification/revision	
	3.8	additions	Strength of fixings	clarification/revision	
		deletion	Available guidance for concrete	clarification/revision	
	3.11	additions and deletions	References	clarification/revision	
	Section 4, title	deletion	Change title of section	clarification/revision	
	4.1	comment	Add reference	clarification/revision	
		comment	Clarification required	clarification/revision	

	4.2	comment	Consider "Green Roofs"	economic, environmental	
	4.4	comment	Delete or change threshold roof loading percentage	uncertain	We feel the AD-A is trying to be more prescriptive and to make sure structural checks are carried out. It seems 15% is reasonable as any over-roofing will add an additional load. But usually a structure is likely to be ok for an extra 10-15%. Anything to close the "loopholes" and make sure buildings are built adequately is of benefit. Similar to item in row 6 & 7 above.
	4.8	addition	Loft conversions section	uncertain	
	The Requirement	comment	Change wording	clarification/revision	
	Performance	comment	In need of re-writing	clarification/revision	
	Secton 5, 5.1a	comment	Revise table	clarification/revision	
	Table 11	addition	Addition of maisonettes	economic	
		addition	Addition of nursing homes	economic, social	
	5.1c	addition	Change of sentence	clarification/revision	
		comment	Need for diagrams	clarification/revision	
	5.1d	addition	Change of sentence	clarification/revision	
		deletion	Removal of reference	clarification/revision	
		addition	Parenthetical	clarification/revision	
		replacement	70 sq m increased to 100	Eurocode-driven	The increase in allowed area of damage to 100m2 per floor can have significant safety and cost effects. There could be cost savings when designing buildings to the new requirement because there may not be a need to design key elements when potential damage to a floor is less than 15% of its area but is between 70 and 100 sq m.. However, owing to the larger area of the structure that can get damaged, this cost saving could be achieved only with higher risks to safety. Society expects buildings to have an acceptable (or tolerable) implied risk. Therefore, any changes to this accepted norm - which has worked well so far - should be based on an appropriate impact study. We propose that changes to human safety risks be studied to understand the implications of the proposed change and, if necessary, to bring forth an acceptable and safe compromise. This study should be a probabilistic risk assessment such as that BRE implemented for LPS building assessment (and which is described in a paper by Dr T D G Canisius).
		addition	Non-regular floor plans	clarification/revision	
		addition	Reference to Eurocode	clarification/revision	
		addition	Class 2A and 2B buildings	clarification/revision	
	5.1e	addition	Class 3 buildings	clarification/revision	
		addition	Added reference	clarification/revision	
	5.2	replacement	BS code change	Eurocode-driven	Steel framed building- CC2B as per EC1-7: CC2 buildings to recommended strategies for **CC1** buildings + provision of effective ties (horizontal and vertical) or a check to ensure stability and limited damage (100m2) upon removal of columns and beams carrying columns. CC1 buildings do not require horizontal or vertical ties. That means EC1-7 allows CC2B buildings to be designed without any horizontal or vertical ties, provided that all columns are designed as key elements. British code however clearly specifies that Class 2B buildings should have horizontal ties and key element design is only an alternative approach to vertical tying . Owing to the proposed change of AD-A to its original form, by changing the current 2004 version which is similar to EN1991-7, Eurocode robustness rules for CC2b buildings become inapplicable to corresponding Class 2B buildings in the UK. This can be mentioned somewhere appropriate.
	5.4	addition	added reference	clarification/revision	
		addition	seismic design reference	Eurocode-driven	
		addition	clarification of seismic design [non-]requirement	clarification/revision	
	Diagram 24	comment	Increase diagram in tandem with 5.1d	clarification/revision	As for 5.1d
	Annex X	addition	Sample proforma sheet	administrative	
		comment	Possible need to re-structure	clarification/revision	
	"Standards referred to"	comment	Updating of BS	Eurocode-driven	

APPENDIX 3: OBSERVATIONS ON THE PROPOSED INCREASE IN THE LIMIT ON FLOOR DAMAGE UNDER DISPROPORTIONATE COLLAPSE REQUIREMENTS

A3.1 Design for consequences of localised failure from an unspecified cause:

A3.2 (Disproportionate collapse checks)

EN 1991-1-7:2006 recommendations:

A3.3 Annex A of EN 1991-1-7:2006 provides information on this aspect.

A3.4 Table A.1 of Annex A provides a categorization of building types/occupancies to consequences classes.

A3.5 Section A.4 gives recommended strategies to provide an acceptable level of robustness to sustain localised failure without a disproportionate level of collapse.

A3.6 As per A.4 (c), for buildings in Consequence Class 2b (Upper Group) the following are recommended:

1. Provide recommended strategies for Consequence Class 1

And

2. Provide horizontal ties and vertical ties in all supporting columns (and any load bearing walls) OR carry out a check to ensure that upon notional removal of each supporting column and each beam supporting a column, or any nominal section of load-bearing wall (one at a time in each storey of the building) the building remains stable and that any local damage does not exceed a certain limit.

The UK National Annex to EN 1991-1-7:2006

A3.7 The UK National Annex to EN 1991--1-7:2006, allows the use of the categorization given in Table A.1 in Annex A of EN 1991-1-7 :2006 for building structures, but does not specifically mention that the recommended strategies given in EN 1991-1-7:2006 A.4 should not be followed, hence allowing one to follow the same.

The UK Building Regulations- Approved Document A

A3.8 As per the UK Approved Document A, a building with a similar classification (equivalent classification in the UK is Class 2B), must be provided with horizontal ties irrespective of whether the alternative approach of notional removal of columns is followed or not. In this document, clearly, the notional removal of column approach is an alternative only for vertical tying of columns.

Effect on structural design

A3.9 If a UK designer opts for the alternative approach given in EN 1991-1-7: A.4 (c) above, for a Consequence Class 2b building, the columns may be designed without any horizontal ties, provided that the column and the structure bearing the reactions from the accidental action (e.g. Concrete floor slab in absence of steel tie beams) can withstand the specified accidental load of 34 kN/m2 (a value specified in both Euro and British codes). This goes against the requirements of AD A. Therefore, although out of the scope of this project, it is suggested here that the UK National Annex be revised to reflect the AD A.

A3.10 The calculations carried out to this effect for the steel building considered in this project, (which is a CC2 –b building), show that the structure designed for resisting ultimate limit state loads can easily withstand the specified loading of 34kN/m2 in an unspecified accidental situation. Hence horizontal ties to columns could have been omitted had the EN 1991-1-7 recommendations were followed. (However, secondary and primary steel beams in every floor in this building would still have provided means of horizontal tying to each column.)

A3.11 The UK Building Regulations however, overrides any standard code of practice. Hence the recommendations given in the current Approved Document A have been followed in the current project. Hence horizontal ties have been provided for all the columns when designed for both Euro and British codes. It has been observed that the resulting horizontal tie forces under the British Codes and the Euro Codes differ in magnitude but not significantly.

Limit of localised damage

A3.12 The maximum limit of localised damage recommended in EN 1991-1-7:2006 is 15% of the floor area or 100m2 whichever is smaller, in each of two adjacent storeys, but the UK National Annex refers to the UK Approved Document A, where this limit is defined as 15% of the floor area or 70m2 whichever is smaller and should not extend further than the immediate adjacent storeys. It is currently proposed that the revised AD A should be changed reflect the Eurocodes' requirement of 100m2.

Effect on the structural design

A3.13 In the design considered here, the alternative approach of notional removal of columns has been chosen thus avoiding design checks for vertical tying of columns. The potential area of collapse upon notional removal of each column has been checked against the minimum specified as per the current UK Approved Document A, which is treated as overriding EN 1991-1-7:2006.

A3.14 Under the current Building Regulations requirements, all the columns in the steel building were found to have fallen into the category of "key elements". It has also been found that the column sizes designed for the ultimate limit state loads to be satisfactory to withstand the recommended accidental load (34 kN/m2), for both British and Euro codes. Thus, for this particular steel building, the change from 70 m2 to 100 m2 did not affect the final column dimensions. However, it may not be so for a different building where the vertical tying requirement is not satisfied, but the potential area of damage falls between the above two values. In such a case, following the increase in the damage limit, the relevant columns will not be designed as key-elements, with resulting potential risks to life greater than when the buildings is designed to the current lower limit of 70m2 of the AD A.

A3.15 The corner columns of the building need not be treated as key elements as per EC-1-7:2006 as the potential area of localised damage due to removal of each of them is less than 100m2. However, methods to ensure that the damage would not extend beyond the immediate adjacent storeys are not clearly defined in the code. Some guidance is given in Annex C of EC-1-7:2006 to assess equivalent static loads due to impacts, but not conclusive. Calculations following a conservative approach based on the guidance given in Annex C showed that the existing structural members of the floor slab need to be significantly strengthened to prevent the damage being extended. This clearly is an uneconomical situation compared to designing the relevant column as a “key element”.

A3.16 In the case of the concrete office building, the alternative approach of notional removal of columns was chosen, in addition to the check for vertical tying of columns, which was satisfied. It was found that all columns were able to sustain a lateral load of 34 kN/m2. Where the potential damaged to a floor is between 70 and 100m2, such as at the corner columns, the Eurocodes do not require stronger corner columns even if they failed the accidental lateral loading test. (However, it is not conclusive on how adjacent storeys’ damage can be assessed.) Thus, especially in the absence of a sufficient amount of vertical tying, in a general situation, the existing AD A requirement on damage area may be considered as safer than the Eurocode design requirement proposed for the revised AD A.

Conclusion

A3.17 The above suggests that the change from the current AD A requirement on disproportionate collapse to that given in the Eurocodes could potentially give rise to safety implications, although it was not for the considered buildings. However, the scope of this project is too narrow to study this matter in detail to produce conclusive recommendations. Therefore, we recommend a detailed study of these aspects be carried out prior to acceptance of the proposed change to the AD A. This study is like to be a probabilistic risk assessment in relation to the current and proposed requirements for a series of buildings with different geometries.

SECTION 2

Draft Impact Assessment prepared for 2010 Review on the Introduction of Eurocodes

(Not used)

Summary: Intervention & Options

Department /Agency: Communities and Local Government	Title: Impact Assessment of the introduction of Eurocodes	
Stage: Consultation	**Version:** 1	**Date:** 22 March 2010
Related Publications: Impact Assessment for Parts A and C		

Available to view or download at:

http://www.communities.gov.uk

Contact for enquiries: Guy Bampton **Telephone:** 020 7944 5758

What is the problem under consideration? Why is government intervention necessary?

The introduction of European structural design codes (Eurocodes) which in 2010 will replace the British Standards design codes referenced in current statutory guidance on Part A and C of the Building Regulations in Approved Document A (AD A) and C (AD C) published in December 2004 and subsequently amended with minor corrections on 27 April 2006 and 28 April 2006 respectively.

CLG is the Government Department responsible for the implementation of the Eurocodes.

What are the policy objectives and the intended effects?

To update and clarify existing guidance. All 58 Eurocodes are now published in the UK by the British Standards Institution along with 44 of the National Annexes which fine tune each Eurocode to suit the UK geographical and climatic conditions. The Eurocodes, like the British Standards design codes, are guidance documents and are not mandatory in the UK but will help to harmonise design standards across Europe. The Eurocodes are likely to be adopted by many countries beyond Europe.

What policy options have been considered? Please justify any preferred option.

1. Do nothing. Keep current references to British Standards in AD A and C. Baseline for comparison, against which any changes to references are measured.

2. The proposed changes to AD A and C to take account of the introduction of Eurocodes. We aim to provide improved guidance on practical ways to comply with Building Regulations in common situations. This option would impose costs on some stakeholders and provide benefits to others (described below).

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? We intend to review the policy as part of the ongoing periodic review of the Building Regulations in [date].

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

....Date:

Summary: Analysis & Evidence

Policy Option: Option 1	Description: No implementation of Eurocodes

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	The one-off costs will apply to structural engineeers in the industry, over an estimated period of two years. Once the Eurocodes have been implemented the net annual costs of this proposal will be borne by construction companies.
£ 0		
Average Annual Cost (excluding one-off)		
£ 0		**Total Cost** (PV) **£ 0**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	In the aggregate, construction companies can be expected to make a slight annual saving (equal to approximately 0.3 per cent of what would be spent per year under the current standards) under the Eurocodes.
£ 0	20	
Average Annual Benefit (excluding one-off)		
£ 0		**Total Benefit** (PV) **£ 0**

Other **key non-monetised benefits** by 'main affected groups'

Further benefits are expected to arise in the form of increased competition which may lead to increased efficiency and ultimately lower prices for consumers.

Key Assumptions/Sensitivities/Risks

Key assumptions included those regarding the expected loss in productivity in adapting to the Eurocodes and the composition of the projected building stock according to different buildings.

Price Base Year 2009	Time Period Years 40	**Net Benefit Range** (NPV) **£ 0**	**NET BENEFIT** (NPV Best estimate) **£ 0**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			2010	
Which organisation(s) will enforce the policy?			Local Authorities	
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			No	
Will implementation go beyond minimum EU requirements?			No	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ n/a	
Will the proposal have a significant impact on competition?			Yes	
Annual cost (£-£) per organisation (excluding one-off)	Micro **TBC**	Small **TBC**	Medium **TBC**	Large **TBC**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ 0 Decrease of £ 0 **Net Impact** £ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: Option 2	Description: Implementation of Eurocodes

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	The one-off costs will apply to structural engineeers in the industry, over an estimated period of two years. Once the Eurocodes have been implemented the net annual costs of this proposal will be borne by construction companies.
£ **118.6m - 178.1m**	2	
Average Annual Cost (excluding one-off)		
£ **0**		**Total Cost** (PV) £ **118.6m - 178.1m**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	In the aggregate, construction companies can be expected to make a slight yearly saving (equal to approximately 0.3 per cent of what would be spent per year under the current standards) under the Eurocodes.
£ **2.7m**	20	
Average Annual Benefit (excluding one-off)		
£ **2.7m**		**Total Benefit** (PV) £ **20.0m**

Other **key non-monetised benefits** by 'main affected groups'

Further benefits are expected to arise in the form of increased competition which may lead to increased efficiency and ultimately lower prices for consumers.

Key Assumptions/Sensitivities/Risks

Key assumptions included those regarding the expected loss in productivity in adapting to the Eurocodes and the composition of the projected building stock according to different buildings.

Price Base Year 2009	Time Period Years 40	**Net Benefit Range** (NPV) £ **-98.6m to -158.1m**	**NET BENEFIT** (NPV Best estimate) £ **-106.8m**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			From 2010	
Which organisation(s) will enforce the policy?			Local Authorities	
What is the total annual cost of enforcement for these organisations?			£ 560,000	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			No	
What is the value of the proposed offsetting measure per year?			£ N/A	
What is the value of changes in greenhouse gas emissions?			£ N/A	
Will the proposal have a significant impact on competition?			Yes	
Annual cost (£-£) per organisation (excluding one-off)	Micro **TBC**	Small **TBC**	Medium **TBC**	Large **TBC**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase - Decrease)
Increase of £ N/A	Decrease of £ N/A	**Net Impact**	£ N/A

Key: **Annual costs and benefits:** **(Net) Present**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Please see separate Section 1 entitled “Consultation Stage Impact Assessment of the Adoption of the Eurocodes: Evidence Base”.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes	No
Small Firms Impact Test	Yes	No
Legal Aid	Yes	No
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	No	No
Race Equality	Yes	No
Disability Equality	Yes	No
Gender Equality	Yes	No
Human Rights	Yes	No
Rural Proofing	No	No

SECTION 3

Consultation Stage Impact Assessment for Amendments to Building Regulations Part A (Structure) and the Associated Guidance in Approved Document A (AD A): Evidence Base

SECTION 3 TABLE OF CONTENTS

1 PART A

Background

1.1 Part A of the Building Regulations requires buildings to be designed and constructed so that they are structurally safe and robust to resist the expected actions to be imposed upon them. Approved Documents (ADs) provide guidance for some of the more common building situations but there is no obligation to adopt any particular solution contained in an AD provided that the relevant requirements are met.

1.2 It has been proposed to change and update certain sections of the guidance provided in AD A to provide greater clarity and thereby to help industry comply with the Building Regulations. Over the years stakeholders requested a number of clarifications on how to interpret the provisions contained in AD A and it was therefore felt that a revision of the document was necessary.

1.3 The most recent revision to Part A, and AD A, occurred in 2004. The most significant change at that time was to bring previously exempt public buildings of less than 5 storeys into the scope of Building Regulations by amending Requirement A3. This sought to reduce the risk of disproportionate collapse. Further significant changes were implemented through amendments to Requirements A1 and A2. In particular, guidance on cavity wall ties was changed to reduce the risk of corrosion, the area over which there are controls for house longhorn beetle attacks was reduced and the recommendation to use grade ST1 concrete was changed because of a concern that its intended properties might not be achieved when used in foundations.

1.4 Many changes will be required to be introduced in AD A as a result of the implementation of the Eurocodes. However such changes are the object of a separate Impact Assessment; here we focus on those changes that are not driven by the Eurocodes.

1.5 This Impact Assessment was conducted by Europe Economics.

Options

1.6 This Impact Assessment considers two policy options:

Option 1: Do nothing

Keep current version of AD A. Baseline for comparison, against which any changes to Building Regulations are measured.

Option 2: Implement the proposed amendments to AD A

This option would impose costs and benefits on stakeholders. The remainder of this Impact Assessment seeks to quantify these impacts relative to the do nothing option and provides a qualitative assessment where quantification is either disproportionate or not possible.

Methodology and Key Assumptions

1.7 The first stage in an Impact Assessment is to determine the policy effects that it is reasonable to assess and to this end we employed a three stage process of identification. This seemingly lengthy process reflects the fact that many of the changes to AD A are clarifications or technical amendments. It would not be reasonable for Europe Economics to determine which changes are significant and which are not without talking to those that have greater knowledge of building construction. Indeed, it might be that a revision of text that appears minor to an economist is in fact extremely significant in the context of building structure, or vice versa. The process we used to determine the significance of each of the numerous changes to AD A was as follows:

(a) Identify all policy changes and changes to associated documents

(b) Refine this list to determine which of these changes might be sufficiently important to warrant quantification

(c) Confirm whether or not the identified changes are indeed significant by talking to CLG and industry experts

1.8 In the first stage of this process, we compiled a table which listed each and every proposed amendment to AD A, no matter how minor. We then refined this by removing from the table any changes that relate to Eurocodes, since these are considered in a separate Impact Assessment. The resulting table is shown in Annex 1.

1.9 In the second stage, we analysed the proposed changes listed in Annex 1 to determine which might be worthy of detailed consideration in the Impact Assessment. The shortlist of changes derived in this stage of the process is shown in Table 1.1 below.

1.10 Following discussions with CLG and industry experts, it was determined that the majority of items on this shortlist were either inappropriate to include in the IA or that attempting to quantify the impacts would be disproportionate given their significance. The conclusion drawn with respect to each item in the shortlist is shown in the third column of Table 1.1.

Table 1.1: Potentially Significant Changes to AD A

Section	Description	Included in IA?
Competency and Responsibilities	Independent review of design philosophy and robustness	Yes, qualitatively. Quantification not proportionate.
Basements	New guidance	No
Malicious actions	New commentary	No
Grandstands	Link to updated and improved guidance	No
Snow loading	New text to improve robustness of buildings to large amounts of snow	No
Wind map	Revision	No; not revised before publication of IA.
Loading on hangers	New text to improve clarity of guidance loading on hangers	Yes, qualitatively. Quantification not proportionate.
Design provisions	Additional guidance with respect to flooding and possible floor collapse	No
Retaining and free-standing walls	New guidance for retaining walls, new commentary for free-standing walls	No
Fixings and connectors	New section	No
After “roof covering”	New section on loft conversions	Yes, qualitatively. Quantification not proportionate.
Nursing homes	Re-classified as 2A and 2B	Yes.
Sample pro forma	New standardised form	Yes.

Source: Europe Economics

1.11 Most of the proposed amendments to AD A will have a negligible impact on industry, CLG and individuals. Given this, it would be disproportionate to attempt detailed quantification of the impact of the majority of these changes. The remainder of this Impact Assessment therefore, while seeking to quantify impacts wherever possible, provides a primarily qualitative discussion of the costs and benefits of the policy options.

Cost/Benefit Analysis

1.12 Policy option 1, the do nothing option, has zero net benefit. Under this policy option, no changes would occur relative to the status quo and hence the option has zero cost and zero benefit.

1.13 Costs and benefits would result from the changes to AD A that would occur given the implementation of the second policy option. Organisations affected by the changes include Building Control Bodies (BCBs), industry and, to a lesser extent, CLG. We identified in Table 1.1 the amendments to AD A that would be included in the cost benefit analysis of this IA and discuss these in more detail below.

Competency and Responsibilities

1.14 This new section of AD A states that sensitive or complex buildings should receive an independent design-stage review as a proportionate risk reduction measure. This is to ensure that the design and construction of the building is conducted by suitably qualified individuals and that appropriate construction materials will be used.

1.15 This amendment to AD A will impose costs on building companies as they would have to require an independent expert to review their design. However this cost should be counterbalanced by the reduction in costs experienced by BCBs: they would have the knowledge that submitted calculations should be of an acceptable standard and easier to approve. The scale of these transfers (from BCBs to builders) is likely to be relatively low, but clearly depends upon the number of buildings that are defined as "sensitive" or "complex". It is not possible to estimate this without constructing a thorough review of building trends, which would extend beyond the scope of this Impact Assessment.

1.16 The benefits of the additional review are extremely difficult to quantify but since the purpose of the review is to improve the average building design and construction and reduce the likelihood of sensitive and complex buildings exceeding their serviceability limit or collapsing, the benefits of the policy would take the form of improved public health and safety.

1.17 It is not possible to determine whether the costs of this amendment to Part A will outweigh the benefits. But given that most of these "costs" are a transfer, for the purposes of this Impact Assessment we therefore assume that the costs and benefits transferred leave very small amounts of impacts unrelated to this primary transfer.

Loading on hangers

1.18 This amendment to AD A requires that a greater proportion of the wall is used to support the floor of a building, thereby creating a more robust building structure.

1.19 It has been noted that sometimes the improper use of joist hangers in houses has been reported leading to failure because the joists have been loaded before there was sufficient dead load of masonry on the end of the hangers. However the change in the AD A is essentially about the order in which the construction activity takes place and should not involve significant changes to the finished construction nor should it have a significant cost impact.

1.20 According to discussions with a member of industry, it is likely to be of the nature of loading processes that all joist hangers need to be assessed for vertical load. Thus this revision would be not much more than a clarification of the existing provisions and not entirely new. The primary benefits thus comprise of marginally more clarity and accessibility for users of this particular paragraph of the guidance document, but are unlikely to be significantly greater than zero.

Loft conversions

1.21 This new section of AD A provides guidance on appropriate designs and procedures for converting lofts into living accommodation. In essence the paragraph provides a simple guide to loft conversions.

1.22 Both costs and benefits of this amendment to AD A accrue to builders, are small in scale, and are not easily quantifiable, especially in the absence of any kind of survey. Builders are likely to incur a negligible cost becoming acquainted with the new guidance. However, the guidance might be beneficial for builders that are undertaking a loft conversion for the first time by reducing the amount of time required to research appropriate methods and might also provide guidance to other builders. It might also reduce the number of inadequate conversions completed by builders that are not aware of guidance on loft conversions, thereby conferring certain non-quantifiable benefits on the dwelling's occupants or on their neighbours.

1.23 The net effect of the provision of guidance on loft conversions is likely to be marginally beneficial.

Nursing homes and residential care homes

1.24 A further change relates to the classification of nursing homes and residential care homes: those not exceeding three storeys have been classed as 2A, while those exceeding three storeys have been classed as 2B. The effect of the change implies that new nursing homes or residential care homes will need to meet the requirements for reducing the sensitivity to disproportionate collapse. While this does not impose significant costs on new constructions, conversions from existing structures may require additional retrofitting of horizontal ties (Class 2A), and possibly also vertical ties (Class 2B).

1.25 Unlike with new designs, it is not feasible to estimate the costs of such a conversion when the process is so heavily case specific, and determining the cost of conversion itself depends upon the nature of the building being converted to the nursing home or residential care home. Unfortunately, retrofit is very different from design, which is relatively much more straightforward for costing purposes. Costs are likely to range vastly and depend on

(a) what is currently in place (type of building, how it is constructed),

(b) the demands of the new requirements (based on the ties required, difficulties of access within an existing building, temporary works etc); and

(c) expected disruption to business as usual (if retrofit is to be done while in the Nursing Home is in operation, if retrofit means the structure cannot be used for a period, etc.).

1.26 However, we can at least draw a conclusion about whether we may expect net benefits or costs from this change. Given that the additional amount spent on satisfying this requirement is done so to preserve the lives of the building's inhabitants, given that the social value of a single Quality Adjusted Life Year (QALY) ranges from £45,000 and £63,000,[1] then even with a very small (0-5 per cent) chance that any disproportionate collapse may be avoided by this measure, a significant amount of value may be generated by the new requirement each year. Because the average life of a building structure in the UK is about 75 years (i.e. we can expect to not need to retrofit each building more than once in 75 years), then it is safe to assume that the expected benefits of this change would significantly outweigh the costs.[2]

Sample pro forma

1.27 Annex X of the 2009 version of AD A contains an outline of a form which might be used by the building industry to submit full plans and calculations to Building Control Bodies (BCBs). This innovation is likely to impact on both BCBs and industry, although the extent of the impact is likely to differ between individual industry participants. The adoption of this form has been recommended by the Standing Committee of Structural Safety.

1.28 The greatest benefit of introducing a sample pro forma is likely to accrue to BCBs and checking engineers. In particular, the administrative cost of reviewing building submissions is likely to be reduced as a result of having a standardised form for two main reasons:

(a) The processing time is likely to be lower than in the absence of such a form.

(b) There would be less need for BCBs to contact those that have submitted applications in order to obtain additional information. The pro forma clearly indicates all of the information that is required and hence the likelihood of industry submitting incomplete and poorly presented calculations would be reduced.

1.29 The benefits to BCBs are likely to be greatest for large scale developments which typically involve considerable calculations of greater complexity, where understanding the design philosophy is of prime importance, than do smaller scale developments. BCBs would incur a negligible cost as employees become familiar with the new pro forma. To the degree that the pro forma prevents industry members from submitting muddled or incomplete calculations to the BCB, there is a transfer of cost from the BCBs to industry. This is likely to be smaller than the benefits gained.

1.30 There is likely to be an unequal impact on different industry participants. Whilst each builder might be expected to incur a negligible familiarisation cost, the sample proforma will reduce the ongoing submission cost for some builders but will raise this cost for

[1] These figures are based on willingness to pay estimates contained in Helen Mason, Andrew Marshall, Michael Jones-Lee and Cam Donaldson, Estimating a monetary value of a QALY from existing UK values of prevented fatalities and serious injuries, Department of Public Health and Epidemiology, University of Birmingham, 2006.

others. In particular, the submission cost might fall for those that are involved in the design and construction of large developments who might previously have submitted more information than was strictly required because of a difficulty in identifying precisely the relevant information for BCBs. However, the fact that the pro forma has been designed so as to apply to every type of building might mean that the submission process becomes more cumbersome for smaller projects who might previously have submitted only a very basic subset of the information listed on the sample pro forma.

1.31 Likewise a section of industry would derive a net benefit from the pro forma whilst others would bear a minimal net cost and it is perhaps reasonable, in the absence of superior information, to assume that the net benefit to industry would be zero.

1.32 Given these factors, it is highly likely that BCBs would secure a net benefit from the inclusion of a sample pro forma in Annex X of AD A as it readily shows the design parameters adopted. Assuming that, excluding the transfer, each BCB employee saves on average half an hour per working week, the benefits had by the pro forma amount to approximately £1,333,000.[3]

Enforcement costs

1.33 There are two principle types of enforcement costs that Local Authorities (LA's), i.e. those responsible for the enforcement of building standards, might be expected to incur:

- One-off enforcement costs; and
- Ongoing enforcement costs.

One-off costs of enforcement

1.34 The changes identified within this impact assessment are principally related to clarifications of the existing guidelines as opposed to revision on them and thus will not have any material effect on the way buildings are constructed. More importantly, these clarifications imply no changes to legislation. On this basis, Local Authorities would not be expected to incur any one-off cost in having to adapt to the changes to AD A set out in this impact assessment (for example, by re-training inspectors in line with new requirements).

Ongoing costs of enforcement

1.35 For the same reasons discussed above, we do expect that Local Authorities would have to spend any additional ongoing resources in enforcing buildings standards as they do

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2 UBS (2008) "Average useful life of building sections" www.ubs.com/1/ShowMedia/ubs_ch/private/mortgage/homeownership/estate/maintenance?contentId=152762&name=FS...E.pdf.

3 Assumptions: average annual salary of BCB employee £25,000; 37.5 hour working; BCBs employ 4,000 staff in England and Wales (see CLG (2008) "Impact Assessment of Amending Part G (Hygiene) of the Building Regulations and the Revision to Approved Document G").

under the present version of AD A. Thus, the expected yearly incremental enforcement costs implied by the new proposal will be zero.

Summary of Cost/Benefit Analysis

1.36 On the basis of the analysis above, the proposed amendments to AD A are likely to have a net benefit of at least £11.5 million over a ten-year build period. In particular, the costs associated with the changes are very limited whilst there are clear benefits to BCBs from the introduction of the sample pro forma; to builders from the inclusion of guidance on loft conversions and to the general public from the clarifications on loading on hangers.

1.37 The change in classification of nursing homes is also likely to deliver significant benefits because the value of potential lives saved is likely to far outweigh the cost of retrofitting existing buildings for new nursing homes. Unfortunately, the cost of doing so is nearly completely case-specific, and will vary enormously. The amount of residents injured or killed by collapse of nursing home structures is also likely to vary annually, and the nature of health economics is such that the most miniscule variation in life saved (or, more precisely, in the length of lives saved) translates into extremely large ranges of QALY values. Another degree of uncertainty is added by the fact that given the average age of nursing home residents, the probability that QALYs salvaged are going to be "complete", or valued at 1 (1=perfect health, 0=death), is miniscule. Owing to these complicating factors, we revise our net benefit estimate to show that it will probably exceed £11.5 million, but it cannot be known by how much: we call £11.5 million our conservative estimate of the net benefits.

1.38 There are no added enforcement costs by revisions to AD A.

Statutory Impact Test (Race, Gender, Disability)

Equalities assessments

1.39 The policy would affect all parties the same regardless of race, gender and disability.

1.40 The proposed policy will not have a negative impact on any racial or gender groups.

1.41 The proposed policy would have the same effect on all parties regardless of disabilities.

1.42 There would not be any impact on human rights.

Other Specific Impact Tests

Competition assessment

1.43 According to the Office of Fair Trading (OFT) competition assessment guidance[4] when analysing competition impacts the following questions should be addressed:

1.44 In any affected market would the proposal:

- Directly limit the range of suppliers?
- Indirectly limit the number or range of suppliers?
- Limit the ability of suppliers to compete?
- Reduce suppliers' incentives to compete vigorously?

1.45 As a result of the proposals, the guidance for the construction of certain building structures would change. This would impact on builders as well as the producers of materials used in construction.

1.46 The principal markets affected by the policy are therefore those for the development of new building structures and the production of construction materials used in those structures.

Directly limit the range of supplier

1.47 The proposals could directly limit the range of supplier of particular types of building structure if they imposed conditions that meant certain structures could no longer be produced by particular suppliers.

1.48 Although the proposed changes may alter the costs to suppliers slightly, they could potentially be complied with by all current suppliers and so there will not be a direct effect on the range of suppliers.

Indirectly limit the number or range of suppliers?

1.49 The proposals may limit the range of suppliers indirectly by having an impact on the profitability of constructing particular building types.

1.50 As described above, the effect of the policy changes are negligible when compared to the overall costs of construction. Although costs may rise slightly for some suppliers, there will be other suppliers for which costs fall, with the overall effect on industry being zero. It

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4 OFT – Completing competition assessments in Impact Assessments, guidance for policy makers, August 2007, OFT876.

is therefore unlikely that the proposals will have an indirect effect on the range of suppliers.

Limit the ability of suppliers to compete?

1.51 A policy may limit the ability of suppliers to compete, for example, by limiting the price that they may charge or the characteristics of the product supplied, e.g. by setting minimum quality standards.

1.52 By imposing additional conditions on builders there may be small effects on the ability of builders to compete, although these are likely to be negligible.

Reduce suppliers' incentives to compete vigorously?

1.53 A policy may reduce suppliers' incentives to compete vigorously by for example, increasing the costs to customers of switching between suppliers.

1.54 There would not be any effect on the incentives of suppliers to compete vigorously.

Overall competition impact

1.55 Although the proposals might result in higher costs for some structures, these would be small when compared to the overall costs of construction and would be offset by lower costs for other structures. The overall competitive effect of the proposals is there likely to be negligible.

Small firms impact test

1.56 The small firms impact test regards all firms with less than 50 full time employees as being small businesses. The majority of small firms have fewer than 10 employees and guidelines state that a concerted effort should be made to consult them over policy proposals.

1.57 The UK construction industry is dominated by small firms. Over 99 per cent of the around 980,000 enterprises in the construction sector in 2007, were small firms[5] with the majority being classified as sole proprietorships. In 2007 small firms accounted for 75 per cent of construction sector employment and over 54 per cent of industry turnover.

1.58 Parties affected by the proposals would include small firms involved in the construction of new buildings.

1.59 There are a number of ways in which small firms may be disproportionately affected by the proposals when compared to how larger firms are affected, for example, it may be

[5] BERR statistics http://stats.berr.gov.uk/ed/sme/smestats2007.xls#'UK Whole Economy'!A1

harder for small firms to alter their design process or cost more for them to train individual members of staff.

1.60 In order to explore the issues facing smaller firms, we carried out interviews with representatives from three small firms involved in the construction trade and one trade association.

Clarity of part AD A

1.61 Generally respondents had some familiarity with parts AD A and found the guidance reasonably clear. However, one of the respondents was concerned that one of the codes (BS 6399 Pt 2 1997) had not been calibrated to reality and made the design of, for example, aircraft hangars impossible. (Note; BS 6399 will be replaced by BS EN 1991.)

Costs and benefits

1.62 Respondents were concerned about the costs of familiarising their staff with the new guidance, in particular the loss of productive time, although costs would depend on the extent of the changes which are minimal in the present case.

Overall small firm impact

1.63 It was felt that the AD A guidance was already reasonably clear. The main cost from the changes would be the costs of familiarisation with the changes. These training costs would impact more on smaller firms as they do not have the economies of scale available to larger firms. However, given that the changes to AD A are small these costs are unlikely to be substantial.

Legal aid

1.64 The proposals would have no impact on Legal Aid.

Small firms defined as firms employing less 50 employees, including sole traders.

ANNEX 1: CHANGES TO AD A

Table A1.1: Changes to AD A excluding those driven by Eurocodes

Section and paragraph	Nature of suggested change	Content area changed	Type of impact
	addition and deletion	Use of guidance	clarification/revision
	addition	How to use this AD	clarification/revision
	additions and deletions	Reference to Regulation 7	clarification/revision
	addition	Competency and responsibilities, Construction (design and management)	administrative
	addition	Basements	administrative
	addition	Malicious Actions	economic, social
"Guidance", 0.2	comment	reference to "Peter Watt email comment"	More on Monday
0.2a	addition	Identification of hazards	clarification/revision
0.2e	addition	Factors of safety	clarification/revision
0.2f	addition	"Actions", and reference to Eurocodes	clarification/revision
0.3	addition	Grandstands	clarification/revision
	deletion	Grandstands	clarification/revision
0.4	addition	Application requirement	administrative
0.5	addition	Conservatories	clarification/revision
0.6	addition	Robust design requirement	administrative
Section 1			
Introduction	deletion	First sentence	clarification/revision
1.9	comment	Link to Part C	clarification/revision
Section 2			
2.1	addition	"and robustness"	clarification/revision
	addition	"Snow loads."	clarification/revision
2.3	comment	Placement of definitions	clarification/revision
	additions and deletions	Definition of terms	clarification/revision
2A2	addition	"and robust"	clarification/revision
	addition	Eurocode reference	clarification/revision
2B	addition	"Snow loading" in title	clarification/revision

2BX	addition	Snow loading requirements	economic, environmental
Diagram X	comment	Redo table	clarification/revision
2C	comment	Explanation	clarification/revision
2C1	comment	Formatting	clarification/revision
2C3c	deletion, addition	Updating	clarification/revision
2C6	comment	Numerical consistency	clarification/revision
2C7	comment	Numerical consistency	clarification/revision
2C8	deletion	Cavity walls in coursed brickwork or blockwork	economic, social
2.8C	addition	Rephrasing of above deletion	carification/revision
2C13	deletion	Minimum thickness requirement	economic, social
After 2C10	comments	Needs to refer to extensions, not garages	economic, social
2C11	comment	"Paragraph should be reviewed."	clarification/revision
2C14	addition, deletion	Specific reference to British Standard	clarification/revision
2C17	deletion, addition	Back reference to section 2C	clarification/revision
2C20	deletion, addition	Rephrasing and new references added	clarification/revision
2C21	deletion, addition	New references added	clarification/revision
2C22	comment	Include wall ties in diagram	clarification/revision
Diagram 6	revision	Wind map to be updated	clarification/revision
Diagram 7	comment	Change title	clarification/revision
Table 5	addition, deletion	Revision	clarification/revision
	comment	Review wall ties	economic, social
Diagram 10	comment	Revision	clarification/revision
2C23	deletion, addition	Change of punctuation	clarification/revision
Diagram 11	comment	Revise diagram	uncertain
2C27	addition	Buttressing walls	economic, social
2C36	addition, deletion	Update reference	clarification/revision
2C37	comment	Add reference to diagram	clarification/revision
Diagram 16	comments	Diagram needs reviewing	Possible cost implications
2C39	addition	Regulation references added	clarification/revision

Diagram 19	comment	Change reference	clarification/revision
2D	comment	Add text to title	clarification/revision
H	comment	Insert cross-reference	clarification/revision
2E2	comment	Provisions require revision	economic, social, environmental
2E2b	deletion	BS code removal	clarification/revision
2E2g	addition	flood risk consideration	clarification/revision
2E3	comment	Section requires revision, and references	economic, social, environmental
	addition	References	clarification/revision
2E4	addition	Depth of strip foundations	clarification/revision
2F	addition	Retaining and free-standing walls	economic, social
Section 3			
3.1	addition	Addition of "window frames"	economic, social
3.3	addition	Use of word "actions"	clarification/revision
	deletion	Use of word “loading”	clarification/revision
	addition	Use of word "actions"	clarification/revision
3.5	addition	Height specification	clarification/revision
3.7	addition	Fixings and connectors	administrative
	comment	Take into account published paper	uncertain
	deletion	Anchors	clarification/revision
3.8	additions	Strength of fixings	clarification/revision
	deletion	Available guidance for concrete	clarification/revision
3.9	addition	More detail on glass	clarification/revision
	addition	Added references	clarification/revision
3.10	addition	Added references	clarification/revision
3.11	additions and deletions	References	clarification/revision
	comment	Need to update references	clarification/revision
Section 4			
Title	deletion	Change title of section	clarification/revision
4.1	comment	Add reference	clarification/revision
	comment	Clarification required	clarification/revision
4.2	comment	Consider "Green Roofs"	economic, environmental

4.4	addition	Add " or decreased"	economic, environmental
4.7	additions	Addition of “significantly” and “by 15%”	clarification/revision
4.8	addition	Loft conversions section	clarification/revision
The Requirement	comment	Change wording	clarification/revision
Performance	comment	In need of re-writing	clarification/revision
Section 5			
Table 11	addition	Addition of maisonettes	economic
	addition	Addition of nursing homes	economic, social
5.1c	deletion, addition	Change of sentence	clarification/revision
	comment	Need for diagrams	clarification/revision
5.1d	deletion, addition	Re-phrased and updated	clarification/revision
5.1e	addition	Class 3 buildings	clarification/revision
	addition	Added references	clarification/revision
5.2	addition, deletion	Updated references	clarification/revision
5.4	deletion, addition	Sentence re-written	clarification/revision
	addition	added reference	clarification/revision
	addition	clarification of seismic design [non-]requirement	clarification/revision
Diagram 24	comment	Increase diagram in tandem with 5.1d	clarification/revision
Annex X			
	addition	Sample proforma sheet	administrative
	comment	Possible need to re-structure	clarification/revision
Standards referred to	comment	Need for updating of references	clarification/revision

SECTION 4

Draft Impact Assessment prepared for 2010 Review of Revisions to Part A of the Buildings Regulations: Approved Document A

(Not Used)

Summary: Intervention & Options

Department /Agency: Communities and Local Government	Title: Impact Assessment of revisions to Part A of the Buildings Regulations : Approved Document A	
Stage: Consultation	**Version:** 1	**Date:** 22 March 2010
Related Publications: Impact Assessment for Part A and the introduction of Eurocodes		

Available to view or download at:

http://www.communities.gov.uk

Contact for enquiries: Guy Bampton **Telephone:** 020 7944 5758

What is the problem under consideration? Why is government intervention necessary?

Harmonised European design codes (Eurocodes) introduced in 2010 will replace the British Standards referenced in current Part A, climate change implications, the Pitt report on flooding and Recommendation 11 that Government look at Building Regulations for flooding, introduction of a section on 'Fixings', clarification of the A3 Requirement to Class 2A and 2B buildings, introduction of a proforma sheet to structural calculations, general updating and additional guidance information.

This review is also part of the periodic review of the Building Regulations.

What are the policy objectives and the intended effects?

To ensure the health and safety of people in and around buildings, and address implications of climate change. In particular, to update and clarify existing guidance in Approved Document A (AD A) published in December 2004 and subsequently amended with minor corrections on 27 April 2006 and 28 April 2006 respectively.

We intend the proposed changes will make buildings more robust, and resistant / resilient to severe weather conditions and adverse events, thereby reducing risk of death and injury, and costs of building repairs.

What policy options have been considered? Please justify any preferred option.

1. Do nothing. Keep current version of AD A. Baseline for comparison, against which any changes to Building Regulations are measured.

2. Implement the proposed changes to AD A. We aim to provide improved guidance on practical ways to comply with Building Regulations in common situations. This option would impose costs on some stakeholders and provide benefits to others (described below).

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? We intend to review the policy as part of the ongoing periodic review of the Building Regulations in [date].

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

....Date:

Summary: Analysis & Evidence

Policy Option: Option 1	**Description: Do nothing**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	
£ 0	10	
Average Annual Cost (excluding one-off)		
£ 0		**Total Cost** (PV) **£ 0**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	
£ 0	10	
Average Annual Benefit (excluding one-off)		
£ 0		**Total Benefit** (PV) **£ 0**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks

Price Base Year	Time Period Years	**Net Benefit Range** (NPV) **£ 0**	**NET BENEFIT** (NPV Best estimate) **£ 0**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?				
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			No	
Will implementation go beyond minimum EU requirements?			No	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **0**	Small **0**	Medium **0**	Large **0**
Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ 0 Decrease of £ 0 **Net Impact** £ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: Option 2	Description: Amend Approved Document A

COSTS

ANNUAL COSTS		
One-off (Transition)	Yrs	
£ 0	10	
Average Annual Cost (excluding one-off)		
£ 0		

Description and scale of **key monetised costs** by 'main affected groups'

The amendment is unlikely to generate any significant costs.

Total Cost (PV) **£ 0**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		
One-off	Yrs	
£ **1,333,000**	10	
Average Annual Benefit (excluding one-off)		
£ **1,333,000**		

Description and scale of **key monetised benefits** by 'main affected groups'

A reduction of administrative burden delivering a benefit of approximatley £11.5 million, as well as several smaller non-quantified benefits which render our estimate a conservative minimum.

Total Benefit (PV) **£ 11.5 million**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks

Price Base Year 2008	Time Period Years	Net Benefit Range (NPV) £ **>11.5 million**	NET BENEFIT (NPV Best estimate) £ **11.5 million**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			2010	
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes/No	
What is the value of the proposed offsetting measure per year?			£	
What is the value of changes in greenhouse gas emissions?			£	
Will the proposal have a significant impact on competition?			Yes/No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **TBC**	Small **TBC**	Medium **TBC**	Large **TBC**
Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ 0 Decrease of £ 11,500,000 **Net Impact** £ -11,500,000

Key: **Annual costs and benefits:** **(Net) Present**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Please see separate Section 3 entitled “Consultation Stage Impact Assessment for Amendment Changes to Building Regulations Part A (Structure) and the Associated Guidance in Approved Document A (AD A): Evidence Base”

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes	No
Small Firms Impact Test	Yes	No
Legal Aid	Yes	No
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	No	No
Race Equality	Yes	No
Disability Equality	Yes	No
Gender Equality	Yes	No
Human Rights	Yes	No
Rural Proofing	No	No

SECTION 5

Consultation Stage Impact Assessment for Amendments to Building Regulation Part C: Evidence Base

SECTION 5 TABLE OF CONTENTS

1 INTRODUCTION AND BACKGROUND

Introduction

1.1 This report sets out the evidence base for the impact assessment of changes to Part C of the Building Regulation related to risks from exposure to radon and from flooding. The first part of this report covers the options for addressing the risks from radon, the second part considers the changes related to risks from flooding. The third section of the report sets out the specific impact tests concerning interaction between these changes to Part C and other government policies.

1.2 Radon is a naturally occurring radioactive gas, which has a widely variable distribution geographically. It concentrates in buildings, with a reduced concentration in upper storeys. Its distribution is linked to the underlying geology, and this can be mapped, but its level in an individual house depends on a number of factors, both related to the precise nature of the rock beneath the house, and the building structure.

1.3 Studies of uranium miners confirmed that radon in high concentrations causes increased incidence of lung cancers, and radon measurement programmes in houses have identified houses where levels are sufficiently high that there is an increased risk to occupants. This risk has been confirmed in large-scale epidemiological studies.

1.4 Radon is now considered to be the second most significant risk for lung cancer after smoking, and is considered to be responsible for around 1,100 Lung cancers annually in the UK, predominantly in smokers and ex-smokers. It should be noted that smoking and radon risks are sub-multiplicative, so that a smoker is around 25 times more at risk than a non-smoker in a high radon environment.

Main Changes in Relation to Radon

1.5 New homes in England and Wales may require either basic or full protection against radon if they are built in areas where existing homes have been shown to have radon levels over the Action Level (currently 200 Bq m^{-3}).[1] More specifically basic radon protection is required in areas where 3 to 10 per cent of existing homes have radon levels over the Action Level, and full radon protection in areas where over 10 per cent of existing homes are affected.

1.6 The existing guidance refers to the radon map BR211 (1999) published in 1999 by Building Research Establishment (BRE).[2]

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[1] Recent epidemiological studies indicate that there is a small increased risk of lung cancer in houses with radon levels in the range 100 to 200 Bq m^{-3}

[2] Building Research Establishment (BRE) Radon: Guidance on Protective Measures for New Buildings Report BR211 (1999)

1.7 The increasing number of radon measurements in existing homes, together with more extensive investigations by the British Geological Survey (BGS), has enabled the Health Protection Agency (HPA) to issue a more detailed atlas with much greater resolution, in paper form with 1 km square resolution (compared to 5km resolutions in the 1999 version).[3] Following this, BRE issued a revision of BR211 in 2007[4] which incorporates the revisions to the radon affected areas, but otherwise keeps similar guidance on constructional requirements. The revised AD C references the latest edition of this BRE report.

1.8 The predominant feature of the greater resolution is to create small additional radon affected areas, predominantly in the 3 to 10 per cent range (i.e. only requiring basic protection), where the lower resolution in the previous advice had indicated no radon problem. Therefore, the changes in the 2007 edition will require more new homes to be protected than under the existing Regulation, and this report assesses the potential number of additional houses requiring protection, the costs involved, and the health benefits likely, if implemented.

Options

1.9 This Impact Assessment covers four policy options:

(a) Option 1: Do nothing. Under this option, no amendments would be made to Part C in respect of radon. Building Regulations and associated guidance would remain unchanged relative to its last revision in 2006. This policy option forms the baseline against which any changes to Building Regulations are measured.

(b) Option 2: Implement the proposed amendments to Approved Document C in 2013 to apply to new dwellings in radon affected areas in England and Wales identified in BR211 (2007) (the targeted approach).

(c) Option 3: Implement the proposed amendments to Approved Document C to apply to all new dwellings in England and Wales (the national approach)

(d) Option 4: Extend basic radon protection to all new schools and offices.

1.10 Options 2, 3 and 4 would impose costs on some stakeholders and provide health benefits to others. The remainder of this Impact Assessment seeks to quantify these impacts relative to the do-nothing option and provides a qualitative assessment where quantification is either disproportionate or not possible.

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[3] HPA/BGS. Indicative Atlas of Radon in England and Wales. Report HPA-RPD-033. 2007. ISBN 978-0-85951-608-2
[4] BRE. Report BR211, Radon: Guidance on Protective Measures for New Buildings. 2007 Edition. ISBN 978-0-84806-013-5

Approach

Assessment of options

1.11 In order to estimate the costs and benefits of the policy options we have followed a four stage process in which we have reviewed:

(a) The number of additional dwellings affected by the new Regulations, split between houses and flats and the number of individuals living in those homes;

(b) The cost of installing a protective membrane and other equipment required to protect residents from exposure to radon;

(c) The number of lung cancers that could be averted over the life of the building by providing this additional protection;

(d) The value to be attributed to this health benefit over the life of the building.

1.12 We have been advised by Dr Antony Denman of the School of Science and Technology at the University of Northampton who has provided estimates of the numbers of lung cancers averted by improved protection from exposure to radon. These are based on methodology developed in earlier studies of radon exposure in the Northampton area. We have also followed the approach used by Dr Denman and his colleagues in earlier studies to evaluate the cost effectiveness of protection policies.[5]

1.13 We have taken into account other studies, in particular, the paper by Gray et al, "Lung cancer deaths from indoor radon and the cost effectiveness and potential of policies to reduce them," and most recently, a comprehensive report on "Radon and Public Health" put out by the HPA.[6,7]

1.14 The following sections set out the approach adopted and key assumptions for each stage of the estimation.

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[5] T Coskeran, A Denman, P Phillips, and R Tornberg. A Critical Evaluation of the Cost-effectiveness of Radon Protection Methods in New Homes in a Radon Affected Area of England, *Environment International, 2009* doi:10.1016/j.envint.2009.04.004

[6] Gray, Alastair, Read Simon, McGale, Paul and Darby, Sarah (2009) "Lung cancer deaths from indoor radon and the cost effectiveness and potential of policies to reduce them" *British Medical Journal* 2009;338;a3110.

[7] Health Protection Agency (2009) "Radon and public health: report of the independent Advisory Group on Ionising Radiation".

2 COST BENEFIT ANALYSIS

2.1 Policy Option 1, the do nothing option, has zero net benefit. Under this policy option, no changes would occur relative to the status quo.

Targeted New Homes

2.2 Policy Option 2 – the targeted approach – involves extending protection to new homes built in the newly identified radon affected areas.

Estimation of affected houses

2.3 The policy period which has been covered in the IA is 10 years from 2013. It is assumed that there is a two year lag before new buildings covered by the 2013 Regulations are occupied so that the first year in which benefits might accrue is 2015. During that period we have assumed an annual new build rate in England and Wales of 150,000 dwellings each of which has 40 year life. The assumed new build rate is consistent with the Consultation IA for Parts F & L of the Building Regulations published in 2009.[8]

2.4 As radon dissipates from the ground, residents of flats on the first floor and above have less exposure to radon and would gain a lower benefit from radon protection. Consistent with the Parts F & L IA we have assumed that 32 per cent of new dwellings are flats and that these, typically, are built in four storey blocks with four flats per floor. On this basis, out of the 150,000 new dwellings 48,000 would be flats in 3000 four storey blocks.

2.5 Average household size has fallen in recent years and further falls are projected. We have taken the latest projection for England in 2011 of 2.28 people per household as our starting point with a reduction to 2.19 in 2021 and to 2.13 in 2031. An occupancy rate of 2.23 has been taken as the average for the 10 year policy period.[9]

Methodology

2.6 As noted above, BR211 (2007) uses a finer resolution than the 1999 map and as a result identifies some small new radon affected areas where protection might be needed. Figure 2.1 provides a comparison of the two maps.

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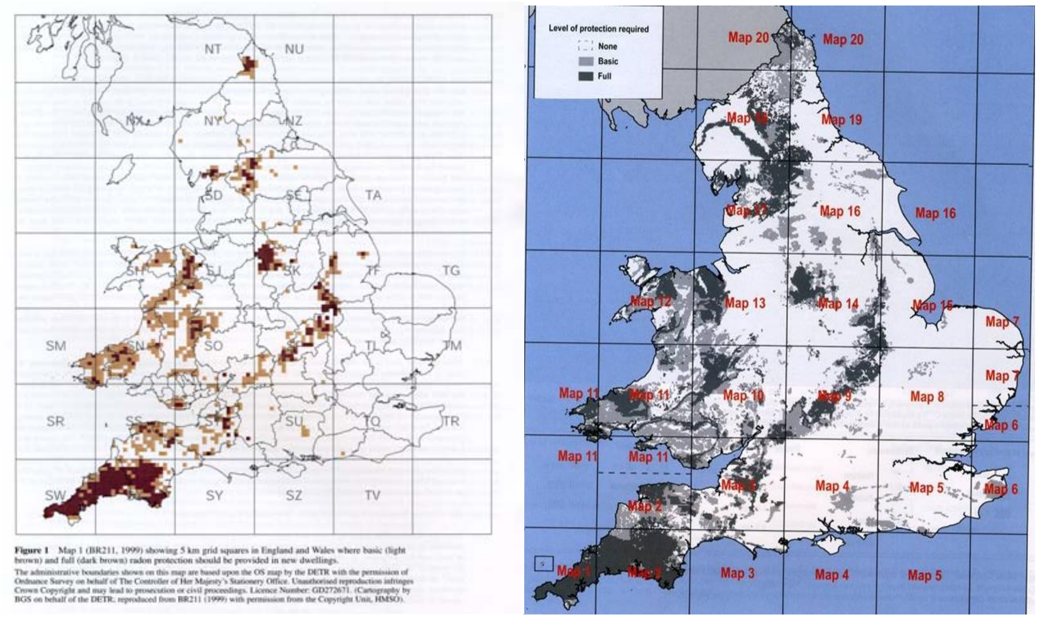
8 Proposals for amending Part L and Part F of the Building Regulations – *Consultation*. CLG June 2009
9 Household estimates and projections, United Kingdom, 1961 – 2031. CLG 2009

Figure 2.1: Comparison of BR211 (1999) and BR211 (2007)



1999 **2007**

2.7 Mapping in 1km squares has led to a greater number of smaller areas which require radon protection being identified, and a reduction in size of some previously identified areas. Notably, a greater number of areas in South West England and North Wales have been identified as requiring protection as well as areas in the Midlands and the North of England.

2.8 There are no significant changes in most of Cornwall, South West Devon, Bath, Northamptonshire, North Derbyshire, Rutland, North Oxfordshire, all of which were radon affected areas in 1999 edition. The large conurbations of London, Manchester, Birmingham, Leeds, Liverpool and Manchester remain without a radon problem. Cornwall, Devon, Derbyshire, Northamptonshire and other local authority areas were designated as radon affected areas in the 1999 edition of BR211, and remain so in the 2007 edition. A detailed list of the affected areas is enclosed in Appendix 1.

2.9 In order to estimate the number of new builds in an area we have assumed that new building is broadly proportional to the existing housing stock. That is the distribution of new build is skewed towards areas with an already high existing housing stock.

2.10 This analysis has the drawback that it is only possible to estimate the number of houses affected in areas where the local authority boundaries match the defined radon affected areas, which is not the case in a significant number of rural local authorities. The method therefore only identifies a definitive minimum number of houses affected under the targeted approach.

Results

2.11 Based on the assumption that there would be 150,000 new dwellings built annually in England and Wales, the minimum number of additional homes caught by the 2007 revision to BR211 is shown in Table 2.1 below. This is divided between houses and flats and between homes in areas requiring basic levels of protection and those requiring full protection. Taking the assumed average occupancy rate of 2.23 people per dwelling there would be about 15,700 people living in these houses and 7,400 in the flats.

Table 2.1: Minimum Additional New Homes requiring Radon Protection under BR211 (2007)

Number of homes in areas requiring:	**Houses**	**Flats**	**Total**
Basic Protection	5,478	2,578	8,056
Full Protection	1,568	738	2,306
Total Homes	7,046	3,316	10,362

Source: Europe Economics and University of Northampton Radon Research Group

2.12 Out of a total of 150,000 new homes in a year it is estimated that around 85,000 would be in areas with no radon problems, some 7,500 would be in areas covered by the 1999 map and around 47,000, predominantly in England, could be in areas we have not been able to categorise.. Some at least of these could require additional protection. The houses which could not be categorised would receive an assessment of radon risk under the BRE/BGS scheme prior to construction; and would be built with protection if appropriate.

Costs of protection

2.13 Basic Protection is the fitting of a gas tight ground barrier to protect against radon ingress. This also acts as a normal damp-proof membrane, which should already have lapped and sealed joints, but should cover the whole building foot print and be sealed to the damp proof course in the walls and sealed around service penetrations.

2.14 Estimates of the additional cost (i.e. over and above the cost of installing a normal damp-proof membrane) made in previous studies vary, as indicated in Table 2.2. It should be noted that the cost will vary with the size, type and proposed construction of building, and whether the home requires protection from chemical contamination. It is possible that other existing policies, such as the need to protect from methane could require the installation of an equivalent membrane and there might be no additional cost in meeting the radon protection level. We have not been able to estimate the numbers of new dwellings which might be protected as a result of other policies but this could reduce the number requiring additional work as a result of the proposed changes to Part C.

Table 2.2: Estimates of additional cost incurred for basic protection against radon

Cost	Reference	Source
£100	Gray et al; 2009	AGIR Report
£200	CLG Impact Assessment; 2004	
£225	Coskeran et al; 2009[10]	Northamptonshire Contractor
£250	Email from HPA	
£350	BRAC Steering Group 30/4/09	
£400	BRAC Steering Group 30/4/09	Note: Revised Value if Lifetime Home Standards introduced

Source: Europe Economics and University of Northampton Radon Research Group

2.15 Full protection requires the radon-proof ground barrier, together with a sump in the foundations, ready to take a fan if high levels of radon are detected after occupancy. Gray et al. 2009 suggest an additional £100 for this, while Coskeran et al; 2009 suggest £85.

2.16 Our working assumption has been to take a mean value of £250 for basic protection for a house and an additional £85 for full protection (taking the cost of full protection up to £335) for houses. .

2.17 A typical flat may have a floor area equivalent to about 70 per cent of the entire floor area of a typical house.[11] Assuming that the cost of protection is proportional to floor area[12], the average cost of providing protection for the ground floor of a typical block of flats would be £1,400 for basic protection[13] and £1,880 for full protection.

2.18 The total cost of installing protection in new homes in designated areas is shown in Table 2.3, the total annual cost of protection works out at £2.2. million.

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[10] T Coskeran, A Denman, P Phillips, and R Tornberg. A Critical Evaluation of the Cost-effectiveness of Radon Protection Methods in New Homes in a Radon Affected Area of England, *Environment International, 2009* doi:10.1016/j.envint.2009.04.004

[11] Research to assess the costs and benefits of the Government's proposals to reduce the carbon footprint of new housing development. CLG September 2008.

[12] The average ground floor area of a house being 42.8 m^2

[13] The £250 cost of basic protection relates to 42.8 m^2 ground floor area of a typical house (85.6 m^2 being the total floor area) or £5.84 per metre.

Table 2.3: Total annual cost of protection in designated areas

	Number of Flats (16 per block)	Average Cost of protection per block	Total annual cost of protecting new flats	Number of Houses	Average Cost of protection	Total annual cost of protecting new houses	Total annual cost of protecting new homes
Basic Protection	2,578	£1,400	£ 226,000	5,478	£250	£1,370,000	£1,483,000
Full Protection	738	£1,880	£ 86,000	1,568	£335	£525,000	£568,000
Total	3,316		£312,000	7,046		£1,895,000	**£2,207,000**

Source: Europe Economics and University of Northampton Radon Research Group

Health benefits

2.19 Radon is linked with lung cancer, and therefore the benefit of the provision of radon protection will be a reduced numbers of lung cancers.

2.20 It is known that both smoking and radon can cause lung cancer and that the combination of exposure to radon and smoking increases the risk further in a multiplicative relation. People have around a 25 times greater risk of lung cancer in a high radon atmosphere if they smoke. Indeed, most radon-related lung cancers occur in smokers. It is not possible to determine whether a lung cancer is caused by smoking or radon.

2.21 In a large population, the lung cancers which can be attributed to radon will therefore occur in both smokers and non-smokers, and the average population risk will be a weighted average of the risk to non-smokers and smokers. The latest estimate of this population risk, from Gray et al of 0.016 increased relative risk per 100 becquerels per cubic metre (Bq m^{-3}) was used as the starting point for our analysis.[14] Survival rates from lung cancers remain low so the major health effect of increased radon protection is the additional years of life resulting from the reduction in the number of lung cancers. Earlier studies have estimated that around 13.5 life years are lost per lung cancer and this value has been used in the current evaluation.[15]

Radon levels before and after policy

2.22 In order to work towards the number of lung cancers averted, we need to estimate the reduction in radon levels as a result of the policy change. Different studies take different views on the effectiveness of membranes in reducing the level of radon.

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14 Bq m^{-3} is a measure of the concentration of radon in air in buildings.
15 Kennedy CA, Gray AM, Denman AR and Phillips PS. A Cost Effectiveness Analysis of a Residential Radon Remediation Programme in the United Kingdom. *British Journal of Cancer*; 1999; 81(7), 1243-7.

2.23 This study follows Gray et al and assumes an average of 50 per cent reduction in the radon level when a membrane is installed. There are limited studies of the effectiveness of membranes, but some, in Northamptonshire and Ireland, have shown that in some cases, radon levels in new protected homes can be over the Action Level of 200 Bq m^{-3}, with an average reduction as low as 16 %. Most recently, Martyn Green has indicated that an HPA survey found an average radon reduction of 42 per cent.[16] The reason why lower effectiveness values have been identified in many studies is thought to be due to improper fitting of the membrane, or damage during installation.

2.24 The Table below represents the radon levels in houses and flats affected before and after the installation of membranes with a 50 per cent effectiveness.

Table 2.4: Mean Radon Levels with and without a Membrane in Existing Houses

	Percentage of homes Over 200 Bq m^{-3}	**Arithmetic Mean Radon Level (Bq m^{-3})**	**Reduction**	**Mean with Membrane (Bq m^{-3})**
Minimum in areas requiring Basic Protection	3%	52	50%	26
Mean in areas requiring Basic Protection	5%	64	50%	32
Max in areas requiring Basic/Min Full	10%	87	50%	43.5
Mean in areas requiring Full Protection	17.0%	116	50%	58

Calculation of lung cancers averted

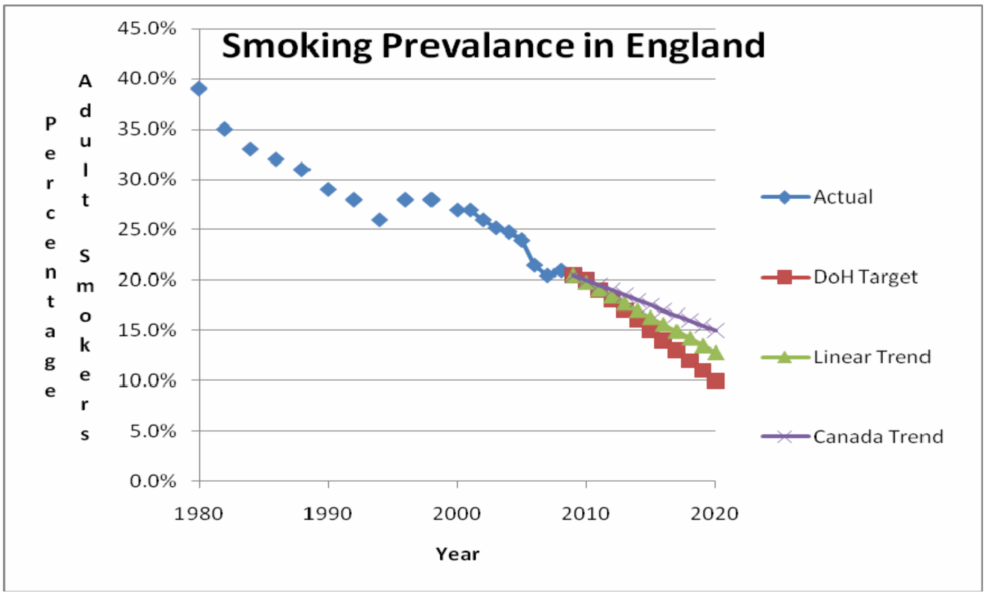
2.25 A linear relationship between lung cancers and radon exposure is assumed. Later we extended this analysis to allow for a lag between exposure and risk of developing cancer. The mean radon reductions of Table 2.4 are combined with the assumed average of 2.23 occupants per dwelling, average occupancy of home by each individual (17.3 hours) and number of houses affected by the policy to get the radon exposure reduction as a result of the programme. This can be converted to the lung cancer reduction from the policy using established values for the risk of lung cancer from exposure to radiation. Separate assumptions have been made about the levels of exposure in houses and in flats with a lower average level of exposure in flats above the ground floor.

16 M.Green. Effectiveness of radon preventive measures in new homes. Environmental Radon Newsletter, Summer 2009, Page 3, HPA.

Prevalence of smoking

2.26 Current Adult Smoking Rates in England continue to drop year on year, from 28% in 1998 to 21% in 2008.[17] The new Department of Health initiative, "A Smokefree Future"[18] aims to accelerate the trend and reach 10% or less by 2020. It should be noted that a linear extrapolation of the current decrease suggests 13% by 2020, and the experiences of Canada and Victoria, Australia in continuing to reduce smoking prevalence below 20%, suggests 15% by 2020. These trends are shown in Figure 2.2.

Figure 2.2: Projected smoking prevalence in England



Notes:- Both Canada and Victoria, Australia have smoking rates below 20%, with a linear reduction at around 0.5% per annum. This is plotted as "Canada Trend". Linear Trend" is the extrapolation of current reduction. "DoH" target is that in "A Smokefree Future", of 10 % or less by 2020, assuming linear progression to the target.

2.27 The significant projected reduction in smoking prevalence in each case will result in a decreasing number of lung cancers averted over time by any radon remediation campaign. Using the values for relative risk of radon and smoking in the recent AGIR report, the impact of the reduction in smoking can be modelled.[19]

Estimated lung cancers averted in newly designated areas

2.28 Using the methodology outlined above we have estimated the number of lung cancers that would be averted every year by the provision of radon protection in the newly designated areas. These estimates are based on the number of homes identified in Table

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[17] Department of Health, Statistics on Smoking: England, 2003. ISBN 1 84182 777 0. November 2003

[18] Department of Health. A Smokefree Future, www.dh.gov.uk/publications, Document 299072, 1 February 2010.

[19] AGIR) Advisory Group on Ionising Radiation. Radon and Public Health. Documents of the Health Protection Agency, Report RCE-11, June 2009. ISBN 978-0-85951-644-0.

2.1 with average occupancy of 2.23 people and have been prepared using differing values for the prevalence of smoking. We have modelled the current level of 21.5 per cent of the population smoking, and the impact of the predicted decreasing prevalence down to the Department of Health target of only 10 per cent smoking by 2020. The estimated number of lung cancers averted annually in the new radon affected areas is shown in Table 2.5. We have taken 15 per cent (highlighted in the table) as a central value for the policy period.

Table 2.5: Lung cancers averted annually (targeted new homes)

Smoking Prevalence	21.5%	21 %	18 %	**15 %**	12 %	10 %
Lung cancers averted in new Radon Affected Areas (2007)	1.07	1.05	0.93	**0.81**	0.68	0.60

Source: University of Northampton

Number of QALYs per lung cancer

2.29 As noted above it has been estimated that an average of 13.5 life years is lost per lung cancer and these can be counted as life years gained if a lung cancer is averted by the policy. In health economics, policy interventions that affect life expectation are conventionally measured not simply in life years but in quality adjusted life years (QALYs). This is a well established methodology that takes into account differences in the quality of life associated with different illnesses and treatments. The use of QALYs allows comparisons to be made between different health-related interventions. The quality adjustment ranges from a value of 1 for perfect health down to zero at death.

2.30 The earlier work by Coskeran, Denman and others which we have already cited derived a quality of life score, based on Department of Health health-related utility scores for England, adjusted to the population mix in the Northampton area of their study. This gave an average quality adjustment factor of 0.8523 if there was no radon protection. The study used a quality adjustment factor of 0.58 for lung cancer sufferers to estimate the higher average quality adjustment factor which would apply across the population if protection was installed and lung cancer numbers fell. This allowed the study to estimate the number of QALYs before and after the policy intervention and thus the additional QALYs attributable to the policy.

2.31 We have adopted the same approach to quality adjustment factors to estimate QALYs gained under different policy assumptions. For each estimate of a reduction in lung cancers we have derived an increased quality of life factor. This can then be applied to the additional life years associated with the cancer cases that have been avoided to give a number of QALYs attributable to the policy. We also considered whether we should attribute a further QALY value, in addition to the additional years of life, to reflect improved quality of life for those who would have contracted cancer without the additional protection. This could be based on the difference between the quality of life factors with and without cancer for the number of years that might have been lived with cancer. However survival rates with cancer are low, only about 20 per cent of patients survive more than one year and only 5 per cent more than five years. The effect of making this second adjustment would be small and we have not included an estimate for this effect.

2.32 QALYs are discounted over the life of the building which has been taken as 40 years in line with the Coskeran study. The discounted QALYs gained can then be compared with the cost of installing the protection, assumed to be borne in the first year, to derive a cost per QALY. These are shown in Table 2.6. Cost per QALY is in the range £7,500 to £13,000 per QALY, rising through the range as the prevalence of smoking decreases. If the cost of protection was ,say, 50 per cent higher than the value we have assumed then the cost per QALY would also increase by 50 per cent.

2.33 This provides a basis for comparison with other health-related interventions for which QALY estimates have been prepared. The National Institute for Health and Clinical Excellence (NICE) uses cost per QALY as a means of evaluating different forms of treatment and has considered treatments costing no more than £30,000 per QALY saved as being 'cost effective'.

Table 2.6: Discounted QALYs gained (targeted new homes)

Smoking Prevalence	21.5%	21 %	18 %	**15 %**	12 %	10 %
Lung cancers averted in new Radon Affected Areas (2007)	1.07	1.05	0.93	**0.81**	0.68	0.60
Discounted QALYs gained	279	274	243	**211**	177	157
Cost of protection £m	2.1	2.1	2.1	**2.1**	2.1	2.1
Cost per discounted QALY gained £	7,527	7,664	8,642	**9,953**	11,864	13,377

Source: Europe Economics

Other issues

2.34 Reduction in the number of lung cancers will result in cost savings from reduced treatment and subsequent care for sufferers. At the same time the longer life expectancy will be associated with some additional health costs and with additional productive activity. We have not estimated these separate and, in part, offsetting impacts on costs.

Aggregation of Costs and Benefits –targeted approach

2.35 In order to provide an estimate of the total cost and benefit of providing protection from radon in the additional targeted areas we have taken the costs incurred in each of the 10 years of the policy period and discounted these back to give a net present value in 2010. On the benefit side we have taken the QALYs gained discounted over the 40 year building life and have valued these at the indicative £30,000 per QALY used by NICE. Benefits are expected to start accruing when the buildings with the protection are occupied from 2015 but have been discounted back to give the NPV in 2010. In line with Treasury guidance a discount rate of 3.5 per cent has been used for the first 30 years and 3.0 per cent for later years.

2.36 We have taken 15 per cent smoking prevalence as a central case. On this basis, as shown in Table 2.7, the targeted protection option has a net benefit of around £30 million NPV. If smoking prevalence is reduced to 10 per cent (the Department of Health target for 2020) the net benefit of the policy falls to about £20 million.

2.37 If a lower value of £20,000 per QALY is assumed then the net benefit, at 15 per cent smoking prevalence, would be about £15 million and at 10 per cent prevalence under £10 million.

Table 2.7: Costs and benefits over the 10 year policy period (targeted homes, building lag only, 15% smoking prevalence)

	Average annual	**Total (PV) over policy period**
Benefits £	870,375	45,876,302
Costs £	(2,207,000)	(15,995,102)
Net benefit £NPV		29,881,200

2.38 A further consideration is that lung cancers attributable to radon only occur some years after the exposure event, with most appearing in the period 5 to 14 years after exposure. Counting benefits in terms of lung cancers averted from the point of first occupation of the building will overstate the benefits gained. As a simple means of exploring the significance of this on overall costs and benefits we have simply shifted the future stream of benefits back in time so that in NPV terms they are less valuable. The results are shown in Table 2.8 for a five year and ten year latency period. Assuming a five year period reduces the net benefit of the policy by around 25 per cent, to £22.6 million NPV. With a ten year latency period the reduction is around 45 per cent with net benefit of £16.5 million NPV.

Table 2.8: Costs and benefits over the 10 year policy period (targeted homes, building lag, 15% smoking prevalence, latency period)

	Average annual	**Total (PV) over policy period with 5 year latency**	**Total (PV) over policy period with 10 year latency**
Benefits £	870,375	**38,626,615**	32,522,574
Costs £	(2,051,000)	(15,995,102)	(15,995,102)
Net benefit £NPV		22,631,513	16,527,471

2.39 We have taken the five year latency period as a central case for the purpose of carrying out sensitivity tests. If the latency period is extended to 10 years the net benefit is reduced to under £20 million NPV. If smoking prevalence is reduced to 10 per cent (the Department of Health target for 2020) and a lower value of £20,000 per QALY is assumed with a 10 year latency, then the net benefit is close to zero.

All New Homes

2.40 Using the approach outlined above, we extended our calculations to evaluate costs and benefits if the policy were to be applied to all new dwellings built in England and Wales from 2013.

2.41 As before, we work on the assumption of a domestic annual build rate of 150,000, which breaks down as follows:

Table 2.9: Additional New Homes requiring Radon Protection

Number of homes in areas requiring protection:	Houses	Flats (32%)	Total
Total Homes	102,000	48,000	150,000
Total homes requiring protection	102,000	12,000	114,000

2.42 The cost of installing the membrane will only apply to those flats on the ground floor, though some benefit feeds through to residents living on upper floors as modelled in the number of lung cancers averted. Using the same assumptions on building size and installation costs as have been applied in the targeted approach above, we have estimated the total annual cost of protecting all new buildings as being in the region of £30 million as shown in Table 2.10. We have also assumed a one off cost of £0.56 million for additional training costs if radon protection was a requirement for all new homes.[20]

Table 2.10: Total annual cost of protection in all new homes

Number of blocks of flats	Average Cost of protection per block	Total annual cost of protecting new flats	Number of Houses	Average Cost of protection	Total annual cost of protecting new houses	Total annual cost of protecting new homes
3,000	£1400	£4,200,000	102,000	£250	£25,500,000	**£29,700,000**

[20] The changes to the AD C transpose existing requirements to new builds in new areas. Therefore there are no new processes for enforcers to familiarise themselves with. However, building control officers will need to make themselves aware of the revised AD C. Using the assumption, as in the impact assessments for Part G and the Eurocodes, of training costs per officer of £140, and considering that there are 4,000 people employed by BCBs, the total one-off cost of familiarisation with the revised AD C comes to £560,000.

2.43 Using the methodology described above for the targeted area to estimate lung cancers averted and QALYs gained, we have estimated the cost per QALY of extending protection to all new homes. This, shown in Table 2.11, is in the range £24,000 to £42,000 per QALY rising through the range as the prevalence of smoking decreases. If the cost of protection is higher than we have assumed then the cost per QALY would increase proportionately.

Table 2.11: Lung cancers averted annually and discounted QALYs gained (all new homes)

Smoking Prevalence	21.5%	21 %	18 %	**15 %**	12 %	10 %
Lung cancers averted	4.48	4.39	3.88	**3.37**	2.86	2.51
Discounted QALYs gained	1169	1145	1012	**879**	746	655
Cost of protection £m	27.6	27.6	27.6	**27.6**	27.6	27.6
Cost per discounted QALY gained £	23,612	24,107	27,276	**31,403**	37,001	42,142

Aggregation of Costs and Benefits – all new homes

2.44 The total cost and benefit of providing protection in all new homes is shown in Table 2.12. At 15 per cent smoking prevalence and a QALY value of £30,000 there is an estimated net cost of £25 million NPV. At 10 per cent smoking prevalence this rises to a net cost of over £70 million NPV. With a QALY value of £20,000 and 15 per cent prevalence the net cost is nearly £90 million NPV and with 10 per cent prevalence there would be a net cost in the region of £120 million NPV. At the 10 per cent prevalence level the value attached to a QALY would need to rise to around £45,000 in order for this policy option to show a net benefit.

Table 2.12: Costs and benefits over the 10 year policy period (all new homes, building lag only, 15% smoking prevalence)

	One off (first year)	**Average annual**	**Total (PV) over policy period**
Benefits £	26,370,000	3,625,875	191,115,021
Costs £	(560,000)	(29,700,000)	(215,720,505)
Net cost £NPV			(24,605,484)

2.45 We have adjusted these costs and benefits for alternative assumptions on the latency period for the development of lung cancer following the same approach as for the targeted homes. This is shown in Table 2.13. With a five year latency period the net cost increase to £55 million NPV and with 10 years latency to £80 million NPV.

Table 2.13: Costs and benefits over the 10 year policy period (all new homes, building lag only and latency, 15% smoking prevalence)

	One off (first year)	Average annual	Total (PV) over policy period with 5 year latency	Total (PV) over policy period with 10 year latency
Benefits	659,250	3,625,875	**160,913,719**	135,485,034
Costs	(560,000)	(29,700,000)	(215,720,505)	(215,720,505)
Net cost £NPV			(54,806,785)	(80,235,471)

2.46 We have again taken the five year latency period as a central case for the purpose of carrying out sensitivity tests. If the value of a QALY is increased to £40,000 then the net cost is reduced close to zero. If the latency period is extended to 10 years with a QALY value of £30,000 then the net cost rises to £115 million NPV. It would be necessary to increase the QALY value to £65,000 to turn this into a small net benefit.

Application of Radon Protection to Schools and Offices

2.47 If the requirement for protection is extended to all new homes then it would also be extended to new schools and offices. The impact of radon on people working in these types of buildings has not been subject to the same degree of research as has been carried out on radon in homes. As a result the estimates we have prepared for this section of the IA are more speculative than those for homes and should be treated with additional caution. We have shown this separately here as Option 4.

Schools

2.48 The analysis for new schools was based on work by Denman and Phillips [21], who studied the radon remediation in all County Council Schools in Northamptonshire, where Northamptonshire County Council had conducted a comprehensive measurement and remediation programme in all Local Authority schools in Northamptonshire in the early 1990s. To extrapolate this analysis to other areas, it was assumed that the school population and buildings would be proportional to the resident population, and that the building of new homes would result in a similar proportion of new schools. As Denman and Phillips did not study private schools, the results were increased by 7 per cent to include private schools.[22]

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21 A Denman, P Phillips. The Cost Effectiveness of Radon Mitigation in Schools in Northamptonshire. J. Radiol. Prot. 18(3), p203-208 (1998)

22 BBC Website – Press Report on Private Schools, June 2000

Cost of protection

2.49 An estimate of the total cost of basic radon protection in schools was calculated given the estimated number of new schools, and the average floor area of these schools used in the IA for Eurocodes, comparing the floor area relative to an average house; and assuming that the costs of protection increased in direct proportion to the floor area. The floor areas used are consistent with the IA for Parts F & L of the Building Regulations. The costs for the targeted proposal were derived pro rata from the new house analysis, It was assumed that the proportion of schools needing full or basic protection was in the same proportion as new homes.

Table 2.14: Average floor area and new build numbers for schools throughout England and Wales

	Houses	**Schools**	
		1 Storey	2 Storey
Average Ground Floor Area (Sq m)	42.8	384	192
New Builds per Year in England and Wales	102,000	480	480
Cost of basic protection per building	£250	£2,242	£1121.5
Total annual cost		£1,076,640	£538,318
Total annual cost across school types			£1,615,000

2.50 Summing the total cost of protecting both 1 and 2 storey schools gives annual cost of protecting all new schools of just over £1.6 million, and for new schools in targeted areas of £112,000.

Benefits

2.51 As with houses, the benefits of radon protection are the reduction in lung cancers. Denman and Phillips studied the complete programme, and published the calculated number of lung cancers averted in pupils and staff. These results were for existing buildings where an average radon reduction of 85 per cent can be achieved using an active pump and sump system, and so, when extrapolating to new schools, the values were reduced pro rata for the 50 per cent reduction assumed for new homes.

2.52 It should be noted that the risk of radon-induced lung cancer in children is not known with any certainty. Lung Cancer is a disease of middle to old age, and the average latency period makes it uncertain whether some lung cancers are induced in childhood. The BEIR VI report[23] suggests using the same risk factor for children, which was assumed in this study. The value obtained by Denman and Phillips was corrected by use of the latest risk factor used by Gray et al.[24]

2.53 The calculated value for lung cancers averted will be lower than in houses. Radon levels are lower during the day and schools will only be occupied in term time. The decrease in smoking prevalence should only affect lung cancers averted in staff and this was not modelled.

2.54 On this basis, we estimate that introducing protection in all new schools in England and Wales would avert **0.015** lung cancers annually, and for new schools in targeted areas would avert 0.005 lung cancers annually.

2.55 Using the earlier relationship between QALYs per lung cancer, school lifetime of 40 years and value of £30,000 per QALY, we estimate that in monetary terms, the policy gives rise to a stream of benefits over 40 years worth £117,000 for each year of policy — the average annual benefits amount to £16,121 Over the lifetime of the buildings there is a net cost of £10.9 million.

Table 2.15: Costs and benefits over the 10 year policy period – all new schools in England and Wales, building lag only

	Average annual	**Total (PV) over policy period**
Benefits £	16,121	849,707
Costs £	(1,615,000)	(11,704,617)
Net cost £NPV		(10,854,910)

2.56 We have also adjusted these estimates to allow for different lung cancer latency periods. Because the numbers of lung cancers averted for schools is already small, there are relatively small changes in the net cost of the policy as the latency period increases, as shown in Table 2.16.

2.57 Costs for this option are high relative to the estimated benefits. It would require a QALY value of over £450,000 for the benefits to equal the costs.

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23 BEIR VI Report. Health Effects of Exposure to Radon. National Research Council. National Academic Press, USA. ISBN 0-309-05645-4. (1999)

24 A Gray, S Read, P McGale and S Darby. Lung cancer deaths from indoor radon and the cost effectiveness and potential of policies to reduce them *BMJ* 2009;338;a3110, doi:10.1136/bmj.a3110

2.58 Applying the 5 year latency assumption to costs and benefits from providing protection to schools in the targeted area shows a net cost of around £0.5 million.

Table 2.16: Costs and benefits over the 10 year policy period – all new schools in England and Wales, building lag and latency

	One off (first year)	**Average annual**	**Total (PV) over policy period with 5 year latency**	**Total (PV) over policy period with 10 year latency**
Benefits £	2,931	16,121	715,431	602,373
Costs £	0	(1,615,000)	(11,704,617)	(11,704,617)
Net cost £ (NPV)			(10,989,187)	(11,102,244)

Offices

Costs

2.59 A similar approach, apportioning the cost of basic protection to the average floor area of new offices, was followed. Our assumptions on the number and type of offices are based on notional building designs by Scott Wilson for the Eurocodes impact assessment.

Table 2.17: Cost of protection for all new offices in England and Wales

	Masonry & Timber <1000 m^2	Concrete <1000 m^2	Steel	Masonry & Timber >1000 m^2	7-storey concrete	7-storey steel
Average Ground Floor Area (Sq m)	200	200	200	200	1,575	1,575
New Builds per Year in England and Wales	7	12	42	33	55	169
Cost of basic protection per building	£1168	£1168	£1168	£1168	£9,200	£9,200
Total annual cost per building type	£8,176	14,016	49,056	38,544	506,000	1,554,800
Total annual cost across building types						**£2,170,600**

2.60 The annual cost of protecting all new offices is almost £2.2 million, and for new offices in targeted areas of £150,000.

Benefits

2.61 As with schools, one needs to take into account the lower exposure in workplaces due to both fewer number of hours spent there on average and lower daytime radon levels.

2.62 Denman et al[25] studied NHS premises throughout Northamptonshire, and similarly published the calculated number of lung cancers averted in staff. The study included all premises in Northamptonshire, which included large modern hospitals, smaller health centres, and houses and bungalows used for respite care. This broad mix of buildings was assumed to represent the varied building stock of workplaces. The result was updated using the latest radon risk factor, and a value for the lung cancers saved per million total population was calculated from knowledge of the total Northamptonshire population and the NHS workforce numbers at the time of the analysis.

2.63 It was estimated that if basic radon protection were to be extended to all new offices (of the type and number assumed above) in England and Wales, it would result in the aversion of 0.075 lung cancers annually, and 0.023 lung cancers in targeted areas. This may be an over-estimate, as new offices may include a number of high-rise blocks where radon levels are negligible on higher floors, whereas the NHS workplace in Northamptonshire is predominantly one and two storey buildings, apart from the major ward blocks of the two major hospitals. This could reduce the number of lung cancers averted by as much as half, with corresponding reductions in the benefit. Given the high level of uncertainty surrounding the estimates for schools and offices we have not made any further adjustment for this effect.

2.64 The net cost of the policy, shown in Table 2.18 over the life of the building is over £11 million.

Table 2.18: Costs and benefits over the 10 year policy period – all new offices in England and Wales, building lag only

	Average annual	**Total (PV) over policy period**
Benefits £	80,604	4,248,536
Costs £	(2,170,600)	(15,731,296)
Net cost £NPV		(11,482,759)

2.65 Adjusting for alternative latency assumptions increases the net cost by between 5 per cent and 10 per cent. With a five year latency period the value attached to QALYs would need to rise to over £130,000 to deliver a zero net cost.

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25 A Denman, S Barker, S Parkinson, P Phillips.The Health Benefits and Cost Effectiveness of the Radon Mitigation Programme in NHS Properties in Northamptonshire. J Radiol. Prot. 17(4), p253-259(1997)

Table 2.19: Costs and benefits over the 10 year policy period – all new offices in England and Wales, building lag and latency

	One off (first year)	Average annual	Total (PV) over policy period with 5 year latency	Total (PV) over policy period with 10 year latency
Benefits £	14,655	80,604	3,577,154	3,011,867
Costs £	0	(2,170,600)	(15,731,296)	(15,731,296)
Net cost £(NPV)			(12,154,142)	(12,719,428)

2.66 Applying the 5 year latency assumption to costs and benefits from providing protection to offices in the targeted area shows a small net benefit of under £0.1 million.

3 SUMMARY FOR RADON

3.1 The estimates set out above indicate that for the base case with 15 per cent smoking prevalence, a five year latency period and a QALY value of £30,000 there is a net benefit of over £20 million NPV for Option 2, the targeted approach, over the 10 year policy period with 40 year building life. However there is considerable uncertainty about the appropriate values to be taken for these key assumptions and we have indicated how different values affect the net cost or benefit for each option. In particular we have looked at different combinations of assumptions which could change a net policy benefit into a cost or a net cost into a net benefit. As shown in Table 3.1 there continues to be a small net benefit for option 2 even when assuming lower smoking prevalence, a longer latency period and a lower QALY value.

Table 3.1: Summary of costs and benefits and sensitivity: Option 2, targeted approach

Smoking prevalence	15%	15%	10%
Latency period	5 years	10 years	10 years
Value of QALY	£30,000	£30,000	£20,000
Benefits £NPV	38,626,615	32,522,574	16,132,841
(Costs) £NPV	(15,995,102)	(15,995,102)	(15,995,102)
Net benefit £NPV	22,631,513	16,527,471	137,739

Table 3.2: Summary of costs and benefits and sensitivity: Option 3, all new homes

Smoking prevalence	15%	15%	10%	10%
Latency period	5 years	5 years	10 years	10 years
Value of QALY	£30,000	£40,000	£30,000	£65,000
Benefits £NPV	160,913,719	214,551,626	100,958,700	218,743,850
(Costs) £NPV	(215,720,505)	215,720,505	(215,720,505)	215,720,505
Net benefit/(cost) £NPV	(54,806,785)	(1,168,879)	(114,761,805)	3,023,345

3.2 For option 3, extending protection to all new homes, there is a net cost of £55 million NPV for the central case. This reduces, Table 3.2, to close to zero with a QALY value of £40,000. If smoking prevalence reduces to 10 per cent then the net cost rises to around £115 million NPV. This converts to a net benefit at a QALY value of £65,000.

3.3 For schools costs significantly outweigh the benefits and this is not greatly affected by changing the latency assumption. As shown in Table 3.3,it would require a very large value to be attached to QALYs for the net cost to be reduced to below £1 million NPV.

Table 3.3: Summary of costs and benefits and sensitivity: Option 4, all new schools

Smoking prevalence	15%	15%	10%
Latency period	5 years	5 years	10 years
Value of QALY	£30,000	£450,000	£30,000
Benefits £NPV	715,431	10,731,461	602,373
(Costs) £NPV	(11,704,617)	11,704,617	(11,704,617)
Net benefit/(cost) £NPV	(10,989,187)	(973,156)	(11,102,244)

3.4 Similarly for offices there are significant net costs for the central case, shown in Table 3.4, although this could be reduced to around zero with a QALY value of £130,000..

Table 3.4: Summary of costs and benefits and sensitivity: Option 4, all new offices

Smoking prevalence	15%	15%	10%
Latency period	5 years	5 years	10 years
Value of QALY	£30,000	£130,000	£30,000
Benefits £NPV	3,577,154	15,500,999	3,011,867
(Costs) £NPV	(15,731,296)	15,731,296	(15,731,296)
Net benefit/(cost) £NPV	(12,154,142)	(230,297)	(12,719,429)

4 FLOODING

Addition of flooding section

Number of developments affected

4.1 In order to assess the aggregate cost imposed by the additional requirements to flood-proof a greater number of developments, the first step would be to estimate the number of units affected. The units affected are primarily extensions and other small-scale developments which do not require planning permission in high flood risk areas. To our knowledge, it is not possible to get data on the number of such developments taking place annually in England and Wales as their very nature implies that local authorities do not need to be notified of their development. Further, not every planning permission granted leads to the development actually taking place and therefore data on planning applications, as available on the CLG website, would not be of great help.

4.2 However since only 10 per cent of the UK is in a high flood risk area, the number of units affected would be a small proportion of the overall number of new developments taking place.

4.3 New regulations governing the construction of domestic extensions in England came into force at the start of October 2008. The changes mean that many people planning to add space to their homes will not require planning permission. The guidance on planning permission remains detailed and can be complex. As an illustration, an extension will not require planning permission if it fulfils a set of seventeen limits and conditions: including that no more than half the area of land around the "original house" would be covered by additions or other buildings; and that no extension would be higher than the highest part of the roof.[26]

4.4 Our working assumption for the purposes of our calculations will be to assume that 40 per cent of extensions do not require planning permission.

4.5 Our suggested approach for this part of the impact assessment is to take a hypothetical small rear extension to a home which does not require planning permission taking place in a high flood risk area and estimate the cost of flood-proofing this development in line with the guidelines provided in the AD C. Aggregation up to the total number of such developments taking place specifically in the areas affected is more challenging.

4.6 We assume the floor area of the extension will be 9m^2 (this is in line with the assumptions on extensions used in Part L and F impact assessment).

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[26] http://www.planningportal.gov.uk/england/genpub/en/1115315206517.html

Methods of protection

4.7 We contacted a number of experts in flooding in order to quantify the costs associated with this policy. There are two main approaches which can be adopted to limit the damage caused by a flood:

(a) Flood resilience or 'wet-proofing': reduces the damage caused by water getting inside a property. According to the AD C, resilience measures should be used exclusively when the flood depth is likely to be above 600 mm. Where the flood depth is between 300 mm and 600 mm then resilience is preferred for new buildings, but resistance can also be followed. The AD C states that:

> they [the measures] can include, for example, tanking, raised electrical sockets, and fitting plasterboard horizontally. Materials used to construct buildings for resilience should themselves be resilient.

(b) Flood resistance or 'dry-proofing': reduces the amount of water that can get into the property. The AD C recommends that they are most effective for short duration and shallow floods — maximum depth of 300 mm above access floor level.

Table 4.1: Examples of flood resilience measures set out in the AD C

Walls	Floors	Windows and Doors	Other
Partial fill cavity walls with closed cell insulation Internal plasterboard, turned to horizontal Lime based hard plaster	Concrete ground supported floors Concrete suspended floors, for sloping sites Floor sump where risk of flood is 20% annual probability	Raised threshold levels, using ramped approach to door PVC-U, solid timber, metal or glazed doors Well sealed window and door frames Well glazed insulating glass units in frames Corrosion resistant fixings	Services (electrical, water, gas) raised above predicted flood level, as possible Seal service penetrations

Source: AD C

Table 4.2: Examples of flood resistance measures set out in the AD C

Temporary	Permanent
Door boards Air brick covers Temporary skirting / membrane	Engineering brick external walls, or other brick types with a low capacity to absorb and transport moisture Rendered external walls Watertight windows and doors Concrete ground supported floors, containing a ground barrier and 150 mm minimum slab Periscope air vents

Source: AD C

4.8 The AD C also mentions avoidance measures, which would only apply in particular situations and be the most costly means of achieving resistance. These include the following:

(a) Raising the ground or floor level, ground raising between 300 mm to 600 mm may be required.

(b) Local bunds to protect groups of buildings from flooding.

(c) Landscaping of a development in order to divert water from buildings.

(d) Boundary walls and fences designed to resist water pressure and with effective seals between walls and gates

Costs of protection

4.9 Clearly the cost of making our hypothetical extension flood-proof would depend on the type of method adopted.

4.10 A report released by the Association of British Insurers in 2006 provided some guidelines on making existing properties flood proof, and the costs associated with doing so.[27]

4.11 According to the report, some flood-resilient measures may not cost much more than standard repairs: for example, moving electric boilers and service meters well above likely flood level will typically cost less than £1000 extra. Although the types of small developments affected by the change are unlikely to involve electric boilers. The additional cost of placing sockets and other electrics above flood level in the construction process is also likely to be very small.

4.12 The report concludes:

> Installing the full suite of measures could add up to £10,000 - £15,000 to the cost of repair, but could save £5,000 - £12,000 in each subsequent flood.

4.13 The cost calculated above refers to buildings and we would need to pro-rata this to our hypothetical small extension. Our extension is assumed to be a rear extension to a detached property with a floor area of 9m^2. Under the new planning permission guidelines single storey rear extensions up to 4 metres deep may be added to detached properties without requiring planning consent (subject to a fulfilment of the other conditions mentioned earlier).[28]

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[27] 'Repairing your home of business after a flood – how to limit damage and disruption in the future', ABI, 2006
[28] On semi-detached and terraced properties, and for all multi storey extensions, the maximum depth is reduced to 3 metres.

4.14 In our impact assessment of Eurocodes we took the average ground floor area of a detached property to be $100m^2$ and we stick with this assumption for this report. Therefore the nine metres square extension represents a nine per cent increase in the ground floor area. Applying nine per cent to the range for the cost of the full suite of flood resilience measures implies a cost range for an extension of £900-£1,350.

4.15 It must also be remembered that the cost calculated above refers to making changes to existing buildings already undergoing repair. Taking flood resilience measures into account during the construction process would alter this cost range (and likely make it lower).

4.16 Another estimate provided to us by the technical contractors indicates that it can cost between £20,000 and £40,000 to make new buildings resilient for long duration floods. This would imply a higher cost range of between £1,800 and £3,600 for an extension, using our earlier assumption on the floor area of an extension. We will use the range £900-£1,350 as our primary range as the range of measures that many extensions requires is likely to be less extensive than the measures required by the entire building.

4.17 Our discussions with engineers from BRE have also pointed to a cost of protection ranging from “hundreds of pounds” to “thousands of pounds”. Therefore the cost of making an extension flood resilient may even be lower than the £900-£1,350 range discussed earlier.

4.18 Alternatively, flood protection products, such as doorguards and airbrick covers, aim to keep the water from entering the property. According to the ABI report referred to earlier these products typically cost between £2,000 and £6,000. We would not expect this cost to be substantially lower for an extension.

Aggregation of costs

4.19 It is difficult to aggregate these costs up for England and Wales since the type of development, its size and hence the cost of flood proofing will vary.

4.20 Figures released by the Association of British Insurers (ABI) estimate that up to 2 million homes in the UK are at risk from coastal or inland flooding, equivalent to 10 percent of the total UK housing stock.[29] Out of these 10 per cent housing stock, only a fraction will be undertaking developments which would be affected by the policy change. The data gathered during Parts L and F analysis, indicates that approximately 150,000 dwellings will be extended each year (based on CLG data). Since 10 per cent of housing stock is in flood risk area, we can assume that 15,000 extensions are likely to take place in the areas of interest. By assuming that 40 per cent of extensions do not require planning

29 http://www.greenlightreport.co.uk/flooding.php

permission, which would give 6000 affected developments, an attempt can be made to aggregate the cost.[30]

4.21 The aggregate cost of making all extensions flood resilient would be in the range of £5.4 million to £8.1 million. Alternatively, taking the average of the cost range — £1125 (and rounding down to £1000 to reflect the fact that flood-proofing new developments is cheaper) — we can estimate that the annual aggregate cost of the policy change would be roughly £6 million.

Cost of enforcement

4.22 In addition to the economic cost incurred during the design and construction process, the main cost borne by the industry would relate to familiarisation with the new guidelines. As far as we can see, the guidelines do not propose new methods of flood proofing but simply apply existing methods to more developments. Therefore, this cost would be relatively small.

4.23 For the reasons discussed in the cost of enforcing the changes related to radon, we would expect both one-off cost incurred by building control officers to familiarise themselves with all changes to the AD C to lie in the region of £560,000.

4.24 The changes are an application of existing guidelines on flood proofing to a greater number of new developments. Since the policy is only expected to affect a small proportion of overall developments, and not all developments are checked for compliance, ongoing costs of enforcement would be very low.

Benefits

4.25 The benefits to be realised from this policy change are primarily the value of flood damage reduction achieved in the future, and this will be the focus for the study. Flooding may also give rise to hidden costs such a loss in property value. In extreme cases, it can also cause injury or loss of life.

4.26 Flood protection has become increasingly more important in light of the growing impact of climate change. For example, the Pitt report stated in reference to the floods of 2007:

> The impact of climate change means that the probability of events on a similar scale happening in future is increasing.[31]

4.27 If the probability and extent of flooding is likely to grow over time, the benefit to be realised from flood proofing is also likely to grow over time.

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30 In addition to extensions, other minor developments such as sheds will be affected by the policy change. Therefore taking the upper limit would partially be reflecting the costs associated with making these additional developments flood proof.

31 The Pitt review: Learning lessons from the 2007 floods, pp. vii

4.28 The value of flood damage incurred varies year by year depending on the severity of weather conditions experienced. It is generally believed to run into the millions with the Environment Agency putting the expected annual damages to residential and non-residential properties in England at risk of flooding from rivers and the sea at over £1 billion.[32]

4.29 We do not have data on the value of flood damage caused in units which did not require planning permission and it is difficult to apportion the total damage to such units.

4.30 One can attempt to apportion the £1 billion worth of annual expected damages to the new extensions affected by the change in the following way. According to the Environment Agency report, around 5.2 million properties in England (or 1 in 6 properties) are at a risk of flooding. We have previously calculated 6,000 as an estimate for the number of extensions affected by the policy change. This represents around 0.12 per cent of the total number of properties at risk per annum. So, we can estimate the annual benefits from the policy would lie in the region of £1.2 million.[33]

4.31 These benefits would potentially be realised each year throughout the lifetime of the development, which is assumed to be 40 years. The costs, however, are one-off.

4.32 The damages likely to be incurred depend very much on the probability of flooding for each individual development and the same value of benefits are not likely to be felt each year. We have run sensitivities on the probability of flooding during the 40 year build lifetime. A 25 per cent probability of flooding implies that it floods 10 out of these 40 years, a 12.5 per cent probability implying it floods 5 out of 40 years and so forth. The stream of benefits for each year of new extensions were aggregated and discounted for a 10 year policy window to produce the results of Table 4.3 below.

Table 4.3: Total cost and benefit and the probability of flooding

	Probability of flooding				
	100%	50%	25%	12.5%	10%
Total cost £ (PV)	51,646,119	51,646,119	51,646,119	51,646,119	51,646,119
Total benefit £ (PV)	413,168,952	206,584,476	103,292,238	51,646,119	41,316,895
Net benefit £ (PV)	361,522,833	154,938,357	51,646,119	0	-10,329,224

4.33 Clearly the net benefits are very sensitive to the probability of flooding, even before the value of damages is accounted for. Taking 25 per cent probability as a baseline still yields positive net benefits.

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32 Flooding in England: A national assessment; Environment Agency, 2009
33 We do not attempt to factor in the damage cost in Wales into this calculation as the figure is approximate anyway.

5 IMPACT TESTS

Statutory Impact Test (Race, Gender, Disability)

Equalities assessments

5.1 The policy would affect all parties the same regardless of race, gender and disability.

5.2 The proposed policy will not have a negative impact on any racial or gender groups.

5.3 The proposed policy would have the same effect on all parties regardless of disabilities.

5.4 There would not be any impact on human rights.

Other Specific Impact Tests

Competition assessment

5.5 According to the Office of Fair Trading (OFT) competition assessment guidance[34] when analysing competition impacts the following questions should be addressed:

5.6 In any affected market would the proposal:

(a) Directly limit the range of supplier?

(b) Indirectly limit the number or range of suppliers?

(c) Limit the ability of suppliers to compete?

(d) Reduce suppliers' incentives to compete vigorously?

5.7 The principal markets affected by the radon changes are those for the development of new buildings and the provision of radon protection products.

5.8 As a result of the policy, more areas have been identified in which all new builds would require either basic or full radon protection. Basic radon protection involves the fitting of a radon-proof membrane, which is of a higher standard than a normal damp-proof membrane. Full-radon protection includes a sump in the foundations alongside the membrane.[35]

5.9 For the changes in relation to flooding, it is principally the market for the construction of minor developments such as extensions which would be affected. The policy has meant

[34] OFT – Completing competition assessments in Impact Assessments, guidance for policy makers, August 2007, OFT876.
[35] A fan may also be required if high levels of radon are detected following testing.

that developments in high risk areas not requiring planning permission would now need to follow the guidelines of the AD C.

Directly limit the range of supplier

5.10 Following the new radon policy there will be increased demand for the provision of radon protection products such as membranes and sumps.

5.11 Suppliers for the required protective materials already exist to cover the areas which have required protection in the past and will continue to do so. Many of the newly identified areas are in close proximity to the areas historically requiring protection (due to the more detailed mapping) and therefore in close proximity to existing suppliers. It seems unlikely that the policy would induce a lessening of supplier competition. On the contrary, it is more likely that the extra demand for the products would stimulate competition amongst suppliers or attract more suppliers into some newly identified areas.

5.12 It is possible that the proposals could limit the number of suppliers providing membranes in a given area if a large number of new builds need to switch from a basic damp-proof membrane to a radon-proof one and there are a more limited number of suppliers of the latter type. However, this is unlikely to apply to a significant number of properties.

5.13 For the construction companies, a £500 additional cost (the upper limit for full protection) for radon proofing a property is unlikely to affect profitability and therefore viability. Since all companies building in a newly identified radon affected area must bear this cost, no one company would be at a competitive disadvantage.[36]

5.14 With regards to flooding, most changes relate to changes in the construction process though there may be some increase in the demand for flood resilient construction materials and flood protection products. All construction companies working on developments affected by the change would have to be compliant with the guidelines, and therefore no one company would be at a competitive disadvantage

5.15 The policy does not relate to identifying new areas requiring flood protection but rather greater number of new developments in previously identified areas requiring flood protection. The supplier base is therefore unlikely to change. Since only around 10 per cent of the UK's housing stock is at a risk of flooding only a small proportion of overall developments will become affected by the policy change.

Indirectly limit the number or range of suppliers?

5.16 The proposals may limit the range of suppliers indirectly by having an impact on the profitability of producing products of particular specifications which are no longer in

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[36] It is likely that the cost would be passed on to the consumer but it is a small cost relative to the value of the house being purchased.

demand as a result of the policy change. The radon-related changes impose an additional requirement on some new builds but are not intended to replace alternative installations and therefore this effect is unlikely to arise.[37]

5.17 Similarly the flooding requirements should not displace any products on a large scale.

Limit the ability of suppliers to compete?

5.18 A policy may limit the ability of suppliers to compete, for example, by limiting the price that they may charge or the characteristics of the product supplied, e.g. by setting minimum quality standards. We do not foresee a significant impact arising in this respect for both radon and flooding.

Reduce suppliers' incentives to compete vigorously?

5.19 A policy may reduce suppliers' incentives to compete vigorously by for example, increasing the costs to customers of switching between suppliers.

5.20 The policy is not likely to have a significant impact in this respect.

Overall competition impact

5.21 Overall the policy is unlikely to have any significant adverse competition effect.

Small firms impact test

5.22 The small firms impact test regards all firms with less than 50 full-time employees as being small businesses. The majority of small firms have fewer than 10 employees and guidelines state that a concerted effort should be made to consult them over policy proposals.

5.23 The UK construction industry is dominated by small firms. Over 99 per cent of the around 980,000 enterprises in the construction sector in 2007, were small firms[38] with the majority being classified as sole proprietorships. In 2007, small firms accounted for 75 per cent of construction sector employment and over 54 per cent of industry turnover.

5.24 The suppliers of radon protection materials include many small firms but there are also major suppliers of membranes such as Monarflex for whom radon sumps and membranes are a sideline of the overall business.

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37 Refer to brief earlier discussion of damp-proof membranes versus radon-proof membranes.

38 BERR statistics http://stats.berr.gov.uk/ed/sme/smestats2007.xls#'UK Whole Economy'!A1
Small firms defined as firms employing less 50 employees, including sole traders.

5.25 Parties affected by the proposals would include small firms involved in the construction of new buildings and in the production of construction materials and particularly the suppliers of products needed to radon proof buildings.

5.26 There are a number of ways in which small firms may be disproportionately affected by the proposals when compared to how larger firms are affected, for example, it may cost more for them to train individual members of staff.

5.27 In order to explore the issues facing smaller firms, we carried out interviews with representatives from three small firms involved in the construction trade and one trade association. We also send out an email to construction firm members of the BERR small firms database asking interested firms to contact us in order to be interviewed.[39]

Clarity of part AD C and familiarity with the BRE report "BR211 (2007); Radon: Guidance on Protective measures for new dwellings"

5.28 Generally the respondents had limited familiarity with part C and the BRE report. One respondent was familiar with the need to prevent build-up of radon in dwellings and other buildings using spacing and ventilation but was unfamiliar with the detail.

Costs and technical challenges of radon-proofing new buildings in affected areas.

5.29 The respondents were uncertain about the costs and technical challenges associated with radon-proofing new buildings in affected areas. One respondent said it was especially unclear what would be required in commercial buildings, and that he was unsure whether the cost would be £100 per unit or £500 per unit.

5.30 Respondents were concerned about the costs of familiarising their staff with the new guidance, in particular the loss of productive time, although costs would depend on the extent of the changes.

Overall small firm impact

5.31 The respondents were generally not familiar with the AD C guidance and it was felt that it was vague. Any training costs associated with familiarising staff with the new guidance would impact more on smaller firms as they do not have the economies of scale available to larger firms.

5.32 The changes in relation to radon do not introduce new unfamiliar practices which firms would need to familiarise themselves with. It is merely an extension of standard practice to new areas. The cost is mainly one of learning the new areas which become affected and these costs are unlikely to be substantial.

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39 We have not received any responses from this.

5.33 The same is applicable to changes in relation to flooding as the same set of practices is to be applied to a greater number of developments.

Legal aid

5.34 The proposals would have no impact on Legal Aid.

Rural proofing

5.35 Rural proofing involves a commitment by the government to ensure its domestic policies take account of specific rural circumstances and needs (Rural White Paper 2000). As a result policy makers should:

(a) Consider whether their policy is likely to have a different impact in rural areas from elsewhere, because of the particular characteristics of rural areas;

(b) Make a proper assessment of these impacts if they are likely to be significant;

(c) Adjust the policy, where appropriate, with solutions to meet rural needs and circumstances.[40]

5.36 The radon-related changes may impact rural areas differently to urban areas if most of the newly identified areas fall into one of the two categories and the cost of protection differs between the two types. The major conurbations of London, Manchester, Birmingham and Leeds remain designated as areas which do not require any radon protection. Most of the newly identified areas would fall into the rural category at least for England. In Wales the situation is more mixed, again predominantly rural, but including the South Wales valleys. Despite this, the cost of either basic or full protection should not differ between rural and urban areas and on this basis we do not believe that the costs of radon proofing would impact rural areas disproportionately.

5.37 As mentioned previously, the flooding-related changes have not identified new areas, rural or otherwise, which have to comply with the guidelines. Therefore, we do not expect a significant impact in this respect.

Health impact assessment

5.38 The positive impacts of the radon-related policy change are intended to materialise in health benefits. Our findings have shown that the policy is likely to avert a number of cases of lung cancer per year. The health benefit of this is quantified in the main text.

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40 DEFRA rural proofing – policy makers' checklist.

APPENDIX 1: NEWLY IDENTIFIED AREAS IN BR211 (2007)

Methodology

(a) Comparison of BR211 (1997) and BR211 (2007) to identify newly affected areas.

(b) Comparison of identified areas and match to local government areas using http://www.gwydir.demon.co.uk/uklocalgov/localgov.htm, to give areas with significant houses (ignoring areas where radon affected areas are rural and much smaller than local government boundaries).

(c) Use of recent government statistics to determine numbers of houses affected.

- House-building: permanent dwellings started and completed, by tenure and district, 2007/08; Table 253; UK Communities and Local Government Office http://www.communities.gov.uk/documents/housing/xls/140921.xls.

- Statistics for Wales report; SDR 34/2009. New House Building (October to December 2008); 11 March 2009. www.wales.gov.uk/statistics

Details of area matching - BR211 – New Edition 2007- Changes from 1999 Edition

A1.1 The primary change is the revision of the map of radon affected areas, following release of new maps by HPA which include results from radon monitoring in a much greater numbers of existing homes. Mapping in the 2007 edition is now in 1 km squares, compared to 5 km squares in 1999.

A1.2 This has led to a greater number of smaller areas which require radon protection being identified, and the reduction in size of some previously identified areas. Where possible areas were then matched to local area boundaries as indicated in bold underlined Capitals. The method of analysis necessarily finds the minimum number of houses affected by the 2007 edition.

Newly identified Areas requiring Basic Protection

A1.3 This analysis may omit some small 1 km square areas. Major conurbations are shown in bold (LA = Local Authority).

1 **BRIGHTON LA** - *Brighton and Hove*, extending north to Pangdean

2 **LEWES LA** - Seaford and Newhaven, and other small villages west of Eastbourne, within A27

3 **ARUN LA** - Arundel, Findon, Angmering, Steyning, Sompting and housing at the rear of Worthing, extending west almost to Chichester.

4 Villages north west of Battle to Burwash Common

5 Staplehurst, Biddenden, Tenterden, Bonnington and other rural villages to west of M20

6 Boughton Aluph, Chilham and rural villages along A28 between Ashford and Canterbury

7 **DOVER LA** - ***Dover, Folkestone, Hythe, Deal*** and surrounding villages extending to Bridge on A2, bordered by B2068 to west, and A257 to north.

8 Reculver (between Herne Bay and Margate)

9 **WAVERLEY LA** - Crawley (south west corner) and rural villages to north of Horsham, including Rusper, Charlwood, Bucks Green

10 Rural Villages to east of Billinghurst along A272

11 Rural Villages along A283, including Plastow

12 Shere, Gomshall, East Horlsey, Shalford, Guildford (southern edge), Puttenham (along A31 hogs back)

13 Rural villages north of Havant, including Horndean

14 Alton, Alresford, and surrounding villages, extending almost to Winchester, Petersfield, and a finger north of A31 extending almost to Farnham

15 Freshwater (Isle of Wight)

16 **EAST CAMBRIDGESHIRE LA** - Rural villages surrounding Ely and extending towards St Ives, including Haddenham, Colne, Fen Drayton

17 Villages north of Kings Lynn on A149, including Heacham, Dersingham, Sandringham and Castle Rising

18 DUDLEY LA - Parts of Dudley, Halesowen, Walsall.

19 **COTSWOLDS LA** -Villages north of Evesham

20 **MALVERN LA** - Great Malvern

21 Villages north of Swansea and Llanelli

22 **SCARBOROUGH LA** - ***Scarborough, Pickering***, and villages to north of A170 including Lockton, and Villages to north and south west of Whitby, including Grosmont

23 Villages to South of North Yorks Moors, including Norton

24 Market Rasen, north to Caistor

25 **CALDERDALE LA** - Calderdale rural area including Littleborough, Todmorden

26 **ROSSENDALE LA** - Rossendale including Rawstenstall

27 OLDHAM LA

28 **ALNWICK LA -** Alnwick, Bamburgh

Newly identified Areas requiring Basic Protection, with localised areas requiring Full protection

29 **PURBECK LA *Swanage*** and southern Isle of Purbeck – full at Kimmeridge

30 Preston, Bincombe, Littlebrady, and other small villages to north west of Weymouth

31 ***Lutterworth***, and villages to south

32 Hurley and other villages to south west of Atherstone

33 Hartshill, Aplsey and other villages to west of Nuneaton

34 Villages to west of Great Malvern, east of Ledbury

35 **GWYNNED** Lleyn Peninsula

36 YNYS MON Angelsey

37 **WAKEFIELD** South Yorkshire including ***Wakefield, Dewsbury, Morley,*** Batley extending close to Barnsley (Basic), small area of Full Protection close to Royston.

38 **WEST LYNDSEY *Scunthorpe*** and surrounding villages

39 Border Forest National Park, including Hexham, Wear Valley, Tynedale

Newly identified Areas requiring Full Protection

40 Isle of Purbeck

41 EAST DEVON Sidmouth, Beer

42 STROUD Dursley

43 Dingle Peninsula, including Rhossli, Bishopston and Orwich

44 **ALLERDALE *Penrith, Cockermouth***, and villages on a crescent reaching down to Telby

45 **RIBBLE VALLEY** including Ribble Valley

46 **NORTHUMBERLAND *Berwick-on-Tweed***, and surrounding villages, including Wooler

Extended Area of Basic Protection

47 **<u>TORRIDGE</u>** North Cornwall and North west Devon, ***Bude,*** Sweets and Hartland

48 ***Chesham***, Chiltern Hundreds

49 Aldbury and other villages to west of Hemel Hemstead

50 Cotswold area bounded by Cheltenham, Circencester, Windrush

Extended Areas requiring Basic and Full Protection

51 Bath, Radstock, Cheddar, Keynsham Area – difficult to evaluated how many additional houses

52 Northamptonshire, Rutland, North Oxfordshire– difficult to evaluated how many additional houses

53 Parts of Forest of Dean, including Lydney, Chepstow and Caldicot

54 South Wales valleys including Ebbw Vale, Abertillery, Caerphilly, Merthyr Tydfil

55 Mid Wales, including Knighton, Newtown, Penybont extending to South Shropshire, at Chruch Stretton

56 West Wales including most of rural Pembrokeshire (***Tenby and Haverfordwest*** are Basic), ***Cardigan, Carmarthen.***

57 Rural area to east of Aberystwyth

58 North Wales including Bangor, Llandudno, Prestatyn, Rhyl, St Asaph, Flint

59 North Derbyshire, including Buxton, Matlock

60 Grantham, Lincoln

61 **<u>RICHMONDSHIRE</u>** North of Preston, ***Skipton***, Settle, Grange-over-sands, ***Barrow-in-Furness***, Hawes, Aysgarth, Kendall, Richmond.

Areas up-rated from Basic Protection to Full Protection

62 ***Barnstaple,*** South Moulton, Braunton, and parts of Exmoor.

63 Torquay

64 ***Cirencester, Stroud*** and surrounding area

No Significant Change

65 Most of Cornwall, South West Devon, Bath, Northamptonshire, North Derbyshire, Rutland, North Oxfordshire. (radon affected areas in 1997 edition.)

66 London, Manchester, Birmingham, Leeds (no radon problem)

SECTION 6

Draft Impact Assessment prepared for 2010 Review of Revisions to Part C of the Buildings Regulations - Domestic

(Not used)

Summary: Intervention & Options

Department /Agency:	**Title:**	
Communities and Local Government	**Impact Assessment of revisions to Part C of the Buildings Regulations - Domestic**	
Stage: Consultation	**Version:** 1	**Date:** 22 March 2010
Related Publications: Impact Assessment for Part A and the introduction of Eurocodes		

Available to view or download at:

http://www.communities.gov.uk

Contact for enquiries: Guy Bampton **Telephone:** 020 7944 5758

What is the problem under consideration? Why is government intervention necessary?

Changes in the information on the health implications and geographic spread of radon protection, climate change implications including flooding and flood performance of buildings, the Pitt report on flooding and Recommendation 11 that Government look at Building Regulations for flooding, introduction of the term 'ground barrier', and general up-dating and additional guidance.

This review is also part of the periodic review of the Building Regulations.

What are the policy objectives and the intended effects?

To ensure the health and safety of people in and around buildings and particularly address the implications of climate change and the revised radon atlas. In particular, to update and clarify existing guidance in Approved Document C published in December 2004 and subsequently amended with minor corrections on 27 April 2006 and 28 April 2006 respectively.

We intend the proposed changes will make buildings more resistant / resilient to severe weather conditions and adverse events, providing protection against radon, thereby reducing risk of death and injury, and costs of building repairs.

What policy options have been considered? Please justify any preferred option.

1. Keep current version of AD C. Baseline for comparison, against which any changes to Building Regulations are measured.

2. Implement a targeted approach to radon protection extending protection to new homes built in newly identified radon areas.

3. Implement basic radon protection in all new homes in England and Wales.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? We intend to review the policy as part of the ongoing periodic review of the Building Regulations in [date].

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

....Date:

Summary: Analysis & Evidence

Policy Option: Option 1	**Description: Do nothing**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'	
One-off (Transition)	**Yrs**		
£ 0			
Average Annual Cost (excluding one-off)			
£ 0		**Total Cost** (PV)	**£ 0**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'	
One-off	**Yrs**		
£ 0			
Average Annual Benefit (excluding one-off)			
£ 0		**Total Benefit** (PV)	**£ 0**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks

Price Base Year	Time Period Years 10	**Net Benefit Range** (NPV) **£**	**NET BENEFIT** (NPV Best estimate) **£ 0**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?				
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes/No	
Will implementation go beyond minimum EU requirements?			Yes/No	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			Yes/No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **TBC**	Small **TBC**	Medium **TBC**	Large **TBC**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ Decrease of £ **Net Impact** £ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: Option 2	Description: Targeted approach - radon protection in new homes in areas with radon levels over Action level

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups' Costs borne initially by developers but ultimately by landowners and owners/users of buildings.
One-off (Transition)	**Yrs**	
£ 0		
Average Annual Cost (excluding one-off)		
£ 2,200,000		**Total Cost** (PV) **£ 16,000,000**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups' Benefits accrue to the occupiers of the new buildings.
One-off	**Yrs**	
£ 160,000	40	
Average Annual Benefit (excluding one-off)		
£ 870,000		**Total Benefit** (PV) **£ 38,600,000**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks The cost incurred over 1 year gives rise to a stream of benefits lasting 40; £30,000 used as the monetary value of a QALY; 15% smoking rate and 5 year latency period as baseline.

Price Base Year 2008	Time Period Years 10	**Net Benefit Range** (NPV) **£ 138,000 to £22,600,000**	**NET BENEFIT** (NPV Best estimate) **£ 22,600,000**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			2010	
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **N/A**	Small **N/A**	Medium **N/A**	Large **N/A**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ TBC Decrease of £ TBC **Net Impact** £ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: 3	**Description: Basic radon protection in all new homes**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	Costs borne initially by developers but ultimately by landowners and owners/users of buildings.
£ **560,000**		
Average Annual Cost (excluding one-off)		
£ **29,700,000**		**Total Cost** (PV) £ **216,000,000**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	Benefits accrue to the occupiers of the new buildings.
£ **660,000**		
Average Annual Benefit (excluding one-off)		
£ **3,600,000**		**Total Benefit** (PV) £ **161,000,000**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks The cost incurred over 1 year gives rise to a stream of benefits lasting 40. £30,000 is used as the monetary value of a QALY, although cost effectiveness, or cost per discounted QALY, remains the key concept. 15% smoking rate and 5 year latency period as baseline.

Price Base Year 2010	Time Period Years 10	**Net Benefit Range** (NPV) £ **-115,000,000 to 3,000,000**	**NET BENEFIT** (NPV Best estimate) £ **- 55,000,000**

What is the geographic coverage of the policy/option?		England and Wales		
On what date will the policy be implemented?		2010		
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?		£ 560,000		
Does enforcement comply with Hampton principles?		Yes		
Will implementation go beyond minimum EU requirements?		Yes		
What is the value of the proposed offsetting measure per year?		£		
What is the value of changes in greenhouse gas emissions?		£		
Will the proposal have a significant impact on competition?		No		
Annual cost (£-£) per organisation (excluding one-off)	Micro **TBC**	Small **TBC**	Medium **TBC**	Large **TBC**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ Decrease of £ **Net Impact** £

Key: **Annual costs and benefits: Constant Prices** **(Net) Present Value**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Please see separate Section 5 entitled, "Consultation Stage Impact Assessment for Amendments to Building Regulation Part C: Evidence Base".

The Evidence Base applies also to the other two summary sheets included in the Part C Impact Assessment.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	*Results in Evidence Base?*	*Results annexed?*
Competition Assessment	Yes	Yes
Small Firms Impact Test	Yes	Yes
Legal Aid	Yes	Yes
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	Yes	Yes
Race Equality	Yes	Yes
Disability Equality	Yes	Yes
Gender Equality	Yes	Yes
Human Rights	No	No
Rural Proofing	Yes	Yes

SECTION 7

Draft Impact Assessment prepared for 2010 Review of Revisions to Part C of the Buildings Regulations - Flooding

(Not used)

Summary: Intervention & Options

Department /Agency: Communities and Local Government	**Title:** Impact Assessment of Revisions to Part C of the Buildings Regulations - Flooding	
Stage: Consultation	**Version:** 1	**Date:** 22 March 2010

Related Publications: Impact Assessment for Part A and the introduction of Eurocodes. This summary sheet should be read in conjunction with TWO other sheets for Part C.

Available to view or download at:

http://www.communities.gov.uk

Contact for enquiries: Guy Bampton **Telephone:** 020 7944 5758

What is the problem under consideration? Why is government intervention necessary?

Climate change implications including flooding and flood performance of buildings, the Pitt report on flooding and Recommendation 11 that Government look at Building Regulations for flooding, and general up-dating and additional guidance.

This review is also part of the periodic review of the Building Regulations. This summary sheet should be read in conjunction with the summaries of the radon-related changes to Part C. All three summary sheets refer to the same evidence base.

What are the policy objectives and the intended effects?

To ensure the health and safety of people in and around buildings and particularly address the implications of climate change which have increased the damage caused by flooding. In particular, to update and clarify existing guidance in Approved Document C published in December 2004 and subsequently amended with minor corrections on 27 April 2006 and 28 April 2006 respectively.

We intend the proposed changes will make all developments in high flood risk areas more resistant/ resilient to severe weather conditions and adverse events, providing protection against costs of building repairs.

What policy options have been considered? Please justify any preferred option.

1. Do nothing. Keep current version of AD C. Baseline for comparison, against which any changes to Building Regulations are measured.

2. Implement the proposed changes in relation to flooding to AD C.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? We intend to review the policy as part of the ongoing periodic review of the Building Regulations in [date].

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

....Date:

Summary: Analysis & Evidence

Policy Option: Option 1	**Description: Do nothing**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'	
One-off (Transition)	**Yrs**		
£ 0			
Average Annual Cost (excluding one-off)			
£ 0		**Total Cost** (PV)	**£ 0**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'	
One-off	**Yrs**		
£ 0			
Average Annual Benefit (excluding one-off)			
£ 0		**Total Benefit** (PV)	**£ 0**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks

Price Base Year	Time Period Years	**Net Benefit Range** (NPV) **£ 0**	**NET BENEFIT** (NPV Best estimate) **£ 0**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?				
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes/No	
Will implementation go beyond minimum EU requirements?			Yes/No	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			Yes/No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **0**	Small **0**	Medium **0**	Large **0**
Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase - Decrease)
Increase of £ 0	Decrease of £ 0	**Net Impact**	£ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: Option 2	Description: Suggested changes to AD C in relation to flooding are implemenetd

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	Costs borne by homeowner/developer.
£ 0	10	
Average Annual Cost (excluding one-off)		
£ 6,000,000		**Total Cost** (PV) **£ 51,600,000**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups' The cost incurred over 1 year gives rise to a potential stream of benefits for the homeowner lasting for the lifetime of the development in the form of savings in the cost of repairs. Any potential benefit depends on the probability and severity of flooding - here 25% probability such that it floods 10 out of 40 years.
One-off	**Yrs**	
£ 150,000	10	
Average Annual Benefit (excluding one-off)		
£ 810,000		**Total Benefit** (PV) **£ 103,300,000**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks Hypothetical extension increases the floor area of a house by 9%, 15,000 new extensions in high flood risk areas of which 6,000 do not require planning permission, expected value of flood damages £1 billion annually in England and Wales. Sensitivity of benefits to different probabilities of flooding modelled.

Price Base Year 2010	Time Period Years 10	**Net Benefit Range** (NPV) **£ -£10m to 362m**	**NET BENEFIT** (NPV Best estimate) **£ 51,600,000**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			2010	
Which organisation(s) will enforce the policy?			Local Authorities	
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ n/a	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **N/A**	Small **N/A**	Medium **N/A**	Large **N/A**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ N/A Decrease of £ N/A **Net Impact** £ N/A

Key: **Annual costs and benefits:** **(Net) Present**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Please see separate Section 5 entitled, “Consultation Stage Impact Assessment for Amendments to Building Regulation Part C: Evidence Base”.

The Evidence Base applies also to the other two summary sheets included in the Part C Impact Assessment.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes	Yes
Small Firms Impact Test	Yes	Yes
Legal Aid	Yes	Yes
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	Yes	Yes
Race Equality	Yes	Yes
Disability Equality	Yes	Yes
Gender Equality	Yes	Yes
Human Rights	No	No
Rural Proofing	Yes	Yes

SECTION 8

Draft Impact Assessment prepared for 2010 Review of Revisions to Part C of the Buildings Regulations - New Schools

(Not used)

Summary: Intervention & Options

Department /Agency:	Title:	
Communities and Local Government	**Impact Assessment of revisions to Part C of the Buildings Regulations - New Schools**	
Stage: Consultation	**Version:** 1	**Date:** 22 March 2010

Related Publications: Impact Assessment for Part A and the introduction of Eurocodes. This summary sheet should be read in conjunction with TWO other sheets for Part C.

Available to view or download at:

http://www.communities.gov.uk

Contact for enquiries: Guy Bampton **Telephone:** 020 7944 5758

What is the problem under consideration? Why is government intervention necessary?

Changes in the information on the health implications and geographic spread of radon protection, climate change implications including flooding and flood performance of buildings, the Pitt report on flooding and Recommendation 11 that Government look at Building Regulations for flooding, introduction of the term 'ground barrier', and general up-dating and additional guidance.

This review is also part of the periodic review of the Building Regulations.

What are the policy objectives and the intended effects?

To ensure the health and safety of people in and around buildings and particularly address the implications of climate change and the revised radon atlas. In particular, to update and clarify existing guidance in Approved Document C published in December 2004 and subsequently amended with minor corrections on 27 April 2006 and 28 April 2006 respectively.

We intend the proposed changes will make buildings more resistant / resilient to severe weather conditions and adverse events, providing protection against radon, thereby reducing risk of death and injury, and costs of building repairs.

What policy options have been considered? Please justify any preferred option.

1. Keep current version of AD C. Do not require radon protection in all new buildings in England and Wales. Baseline for comparison, against which any changes to Building Regulations are measured.

2. Implement basic radon protection in all new homes, extensions, conversions and non-domestic builds including schools and offices. We aim to provide improved guidance on practical ways to comply with Building Regulations in common situations. This option would impose costs on some stakeholders and provide benefits to others (described below).

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? We intend to review the policy as part of the ongoing periodic review of the Building Regulations in [date].

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

....Date:

Summary: Analysis & Evidence

Policy Option: Option 1	**Description: Do nothing**

COSTS			
ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'	
One-off (Transition)	**Yrs**		
£ 0			
Average Annual Cost (excluding one-off)			
£ 0		**Total Cost** (PV)	**£ 0**
Other **key non-monetised costs** by 'main affected groups'			

BENEFITS			
ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'	
One-off	**Yrs**		
£ 0			
Average Annual Benefit (excluding one-off)			
£ 0		**Total Benefit** (PV)	**£ 0**
Other **key non-monetised benefits** by 'main affected groups'			

Key Assumptions/Sensitivities/Risks

Price Base Year	Time Period Years	**Net Benefit Range** (NPV) **£ 0**	**NET BENEFIT** (NPV Best estimate) **£ 0**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?				
Which organisation(s) will enforce the policy?				
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes/No	
Will implementation go beyond minimum EU requirements?			Yes/No	
What is the value of the proposed offsetting measure per year?			£ 0	
What is the value of changes in greenhouse gas emissions?			£ 0	
Will the proposal have a significant impact on competition?			Yes/No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **0**	Small **0**	Medium **0**	Large **0**
Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)			(Increase - Decrease)
Increase of £ 0	Decrease of £ 0	**Net Impact**	£ 0

Key: **Annual costs and benefits:** **(Net) Present**

Summary: Analysis & Evidence

Policy Option: Option 4	**Description: Basic radon protection in all new schools and offices**

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition)	**Yrs**	Cost of protecting against radon of all new schools and offices constructed in one year in England and Wales. Total PV cost breaks down into £11.7m for schools and £15.7m for offices. Costs initially borne by developers ultimately by landowners or owners of buildings
£ 0	10	
Average Annual Cost (excluding one-off)		
£ 3,786,000		**Total Cost** (PV) **£ 27,436,000**

Other **key non-monetised costs** by 'main affected groups'

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups'
One-off	**Yrs**	Total benefits (PV) breaks down as £715,400 for schools and £3,577,000 for offices. Benefits will accrue to occupants/ users of the buildings.
£ 17,600	10	
Average Annual Benefit (excluding one-off)		
£ 96,725		**Total Benefit** (PV) **£ 4,293,000**

Other **key non-monetised benefits** by 'main affected groups'

Key Assumptions/Sensitivities/Risks Building lifetime of 40 years, cost of protecting homes adjusted to floor size of typical schools and offices. £30,000 is used as the monetary value of a QALY. 15% smoking rate and 5 year latency period as baseline.

Price Base Year 2010	Time Period Years 10	**Net Benefit Range** (NPV) **£ -23,800,000 to -1,200,000**	**NET BENEFIT** (NPV Best estimate) **£ - 23,140,000**

What is the geographic coverage of the policy/option?			England and Wales	
On what date will the policy be implemented?			2010	
Which organisation(s) will enforce the policy?			Local Authorities	
What is the total annual cost of enforcement for these organisations?			£ 0	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			Yes	
What is the value of the proposed offsetting measure per year?			£ n/a	
What is the value of changes in greenhouse gas emissions?			£ n/a	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro **N/A**	Small **N/A**	Medium **N/A**	Large **N/A**
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Increase of £ N/A Decrease of £ N/A **Net Impact** £ N/A

Key: **Annual costs and benefits:** **(Net) Present**

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Please see separate Section 5 entitled, "Consultation Stage Impact Assessment for Amendments to Building Regulation Part C: Evidence Base".

The Evidence Base applies also to the other two summary sheets included in the Part C Impact Assessment.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes	Yes
Small Firms Impact Test	Yes	Yes
Legal Aid	Yes	Yes
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	No	No
Health Impact Assessment	Yes	Yes
Race Equality	Yes	Yes
Disability Equality	Yes	Yes
Gender Equality	Yes	Yes
Human Rights	No	No
Rural Proofing	Yes	Yes

Department for Communities and Local Government

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